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Project documentation

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Table of contents

1. PROJECT SCOPE **1**

2. INTRODUCTION **2**

3. BUSINESS IDEA **3**

3.1 VALUES FOR THE USER AND INVOLVED COMPANIES 3
3.2 SWOT ANALYSIS 4
3.3 FIVE COMPETITIVE FORCES 6
3.4 CLIENT 7
3.5 BUDGETING 8

4. PROJECT ADMINISTRATION **9**

4.1 MANAGEMENT PROCEDURES 9
4.2 MANAGEMENT OF DIARIES 10
4.3 SUB GROUPS 10

5. SYSTEM DEVELOPMENT **11**

6. INCEPTION PHASE **13**

6.1 FEASIBILITY STUDY 14
6.2 SYSTEM REQUIREMENTS 15
6.2.1 Mobile platform *16*
6.2.2 Administration platform *16*
6.2.3 User portal *16*
6.3 RISK ASSESSMENT 16

7. ELABORATION PHASE **18**

7.1 SOFTWARE ARCHITECTURE 19
7.1.1 Mobile platform *20*
7.1.2 Administration platform *21*
7.1.3 User portal *24*
7.2 TEST AND VALIDATION 25
7.2.1 Usability testing on design *25*
7.2.2 Validating build *26*

8. CONSTRUCTION PHASE/TRANSITION PHASE **28**

8.1 FINAL DESIGN 29
8.1.1 Mobile platform *29*
8.1.2 Administration platform *34*
8.1.3 User portal *39*
8.2 FINAL TESTING AND VALIDATION 42
8.2.1 Mobile platform *42*
8.2.2 Administration platform *44*
8.2.3 User portal *45*

9. DISCUSSION **47**

9.1 GROUP INTERACTION AND WORK 47
9.2 SYSTEM DEVELOPMENT 49
References

Appendixes

Appendix A: Stakeholders
Appendix A: Competitors
Appendix B: Time Schedule with milestones
Appendix C: Mobile platform
Appendix C: Administration platform
Appendix C: User portal
Appendix D: Risks
Appendix E: First version
Appendix E: High level system architecture
Appendix F: Table code and restrictions
Appendix G: Early flow design of the J2ME application
Appendix H: initial class diagram of the J2ME application
Appendix H: Final class diagrams
Appendix I: The first prototype
Appendix I: The second prototype
Appendix J: User portal design/description
Appendix K: Cognitive Walkthrough test
Appendix K: The test subjects
Appendix K: The failure document
Appendix L: State diagram of the GUI
Appendix M: The acceptance test
Appendix N: Functionality test, the administration platform

Figure Index

Figure 1. The SWOT analysis of our service *5*
Figure 2. The different phases that is available in the OUP methodology *11*
Figure 3. Initial state Diagram of the mobile platform *20*
Figure 4. The structure of the administration platform *22*
Figure 5. Database prototype: tables and relationships 23
Figure 6. The three different screens of the wap page for the user portal *24*
Figure 7. Actions created *26*
Figure 8. Context aware soft keys: from left to right, zoom out, show information *31*
Figure 9. Pointer in overview *32*
Figure 10. Simplified state diagram of the final design *33*
Figure 11. Font sizes and colours *33*
Figure 12. The login page of the administration platform *34*
Figure 13. Administration page to create a new user *35*
Figure 14. Client page to add a new shop *36*
Figure 15. Client page to add comments *37*
Figure 16. The first screen of the user portal with the demo emulator *40*
Figure 17. The download application screen *40*
Figure 18. The help screen and the requirements of the mobile phone *41*
Figure 19. The logo in the top-left corner and the menu with text grouping *41*
Figure 20. Showing the color for visited and unvisited links *42*

Table Index

Table 1. Five competitive forces *6*

1. Project scope

The MAPI (map information guide) project was a collaborative work between six students at Halmstad University in the autumn of 2006. The main goal of the project was to develop a mobile information guide application that is put to use as an interactive map where you could get information about the environment, this is the information that the mobile phone displays, and the information displayed is according to the user's interest.

We acknowledged that when tourists come to new cities they often contact the local tourist office to ask the questions of what and where current events and tourist attractions are happening (Crabtree, 1999). Even if they get a map and description of where they can go, it could be a problem to use it correctly. We therefore felt that a mobile could help the user to determine where they can find interesting events and places in a city by showing information that wouldn't be displayed on an ordinary map. When we decided to make this application we also made some secondary goals for the system/application:

- Fast
- Easy to update
- User friendly
- Free for the user
- Propose an profitable system for the clients

These secondary goals can be seen as more visionary goals; it was something we tried to accomplish but some of them are hard to test during the scope of our project. The first two are connected to the third one, a user friendly system, and this is something we set out to test during our development process. The outcome of the last two, however, is probably decided in an unforeseen future.

The basic idea of the application is that the user only needs a mobile phone with the ability to connect to the Internet. By using the Internet the user can connect to our *user portal* and download the map application of a specific city (in this case Halmstad). When the user has started the application the user can navigate the map and with the map there will be icons that represent different locations of interest. These icons will be different depending on what the user wants to have information about, and this should be customized on the mobile phone. The information displayed should be easy to customize. Our suggestion is that the user could choose different 'skins' and that these skins would represent different types of stores and events. Our vision is that these icons will help the stores to market their self directly to new clients and customers. The icons in the different skins have information that is updateable; the user will always have the latest information from the tourist offices and stores. The user will have to connect to the Internet, through GPRS, in order for the updates to be visible in the application.

Our main system and service consists of three different platforms that are connected to each other. We have *the user portal*, *the mobile platform*, and *the administration platform*. The mobile platform is the main application but in order to get it to run correctly we have to have an administration platform where future clients could login and save their information in a database (a database that the mobile platform can connect with). The user portal is used for distributing the mobile application and showing new users how the application will work, by showing a demo of the GUI (Graphical User Interface) of the mobile application. This document will show how this process evolved in to a fully working system.

2. Introduction

The map has been a tool for mankind to find out where they can go and what the world around them looks like. It has been used for centuries and its significance for explorers and tourists have probably continued to grow over the years. These days you could get a map of almost anything. When talking about city maps, the user can usually get this at a store or a tourist information office, but the Internet and the Yellow Pages usually provides this kind of service as well. If the user has an ordinary paper map the information that the map stores will be static, it will never change (unless of course you exchange the map for a new one). The terrain of the map will probably be the same during a ten year period, but the icons and "events" that these city map shows often change dynamically during this period. This information could instead be changed on a web page or on a mobile service.

We are mainly interested in mobile services, e.g. mobile maps, and how they can be implemented for the users in a cheap and comfortable way. This means that our service provides a map downloaded directly to the user's mobile phone and it's stored in the free memory of the mobile phone. The maps that you could use on a mobile phone today are in most cases connected to an application on the web, and therefore it costs to use it every minute for connection to the Internet. The information that is stored on these maps is detailed, but the user has to be connected to get hold of the updates. The user still have to update with our application that means connect to the Internet, but the updates will be sporadic and shouldn't be necessary all the time. Our idea is that the information will be downloaded from time to time and saved in special categories, or skins, in order to sort the information in a convenient way. This way the user could get more information based on what they are interested in and looking for. The user will always have the map with them and they will do the updates when they feel like it. This is probably not a unique idea in it self, but it's simple and easy enough to work in theory. Our goal is to also make it work in practice.

3. Business idea

We promote a service that could serve a tourist a city guide via a mobile phone. We aim at Halmstad city first of all, namely for the 700 years celebration, as a promising time gap to intervene into the market. So, what do we offer as a substitute or a complement for the existing services of this kind and why would our target audience use it? First of all, the service is a great complement to our biggest competitor – paper maps, used by for centuries. Instead of folding and unfolding the paper map, a tourist would have the possibility to get the most important information, such as shops, museums, events locations, using a mobile phone. Paper maps can be wore out, ripped and outdated, and the mobile phone is also something that people carry with themselves all the time, no need to bother taking extra things is therefore a great advantage. It's not only a paper map that's used for similar services – a range of software applications are available for tourists, but we differentiate ourselves in some ways: we only concentrate on the most important information for a tourist, such as shops, current exchange points, information centres, etc.

Our vision is that the application is downloaded to the mobile phone and that it's not required to have a constant connection established to the Internet in order to use it. The application is free and should be easy to use. Users will have a possibility to apply skins, such as showing only certain objects on the map at a time, like shops, theatres, sport events, etc.

As mentioned, the application could be presented for the tourists who visit the city for the celebration of the 700 years, which would probably be the best time to promote the product. In the future it could be reused for other Sweden cities, like Gothenburg, and hopefully other countries, for example, Lithuania. So what is the strategy, what values will we propose, and how will we promote our service to the market?

3.1 Values for the User and involved Companies

How would this service attract the user? First of all, having all basic info needed for a tourist just in your mobile phone is very convenient and flexible. You don't have to carry maps, which might be really inconvenient when it comes to harsh weather conditions (windy), and it doesn't wear off nor is it torn. You also don't have to bother about buying a map, as you can simply download it from the Internet and have it with you all the time. The user will probably not forget their mobile phone, but they are more likely to forget a map. We target primarily mobile phones, not PDAs, because mobile phones are cheaper than PDAs, and most people already have a mobile phone [1]. The service we propose will not require any specific features for the mobile phones; the minimum requirements should be a Java-compatible phone with a 128x160 Color-screen, GPRS and WAP connection. Another strong advantage is the simplicity and speed as the mobile tourist guide will include only basic and important information needed for tourists and will not be overloaded with, as we see it, unnecessary information.

Tourists will also be able to take a look at the events of the day, happening in the town, look for its location and brief description. Hence, user would always have an opportunity to attend a desirable event and be 'up-to-date'. Our mobile tourist guide will provide skins, which would make a better view on the town without any unnecessary info, which might be only disturbing (say, shop skin, depicting shops of interest, or a hostel skin, etc.).

Another attractive feature, planned for the future, is the ability to leave a note related to a particular place (shop, restaurant, etc.) on the city map, comments, and impressions of a particular event. Tourists might find it interesting/useful to read other people comments of whether a particular place is worth visiting. We have talked about the users, but who would take advantage of this product? Firstly, this could serve as an advertisement service for the city, attracting new tourists, showing certain stores or other info for tourists, gaining value for the contest "The city centre of the year 2007". Tourist information offices would gain value of administration of daily events – advertising, showing updates and promoting information for loggings, etc. This is more information than a paper map can give (more information about the stakeholders in *appendix A: Stakeholders*).

For restaurants there is an advantage if there are more clients, not only people that passes by. A possibility to leave comments on a particular occurrence, like live concerts, or opening hours, is a great plus in terms of advertising. Other clients, for an example local shops and hostels, could also take advantage by advertising their services to attract customers and gaining competitive advantage against businesses of similar profile.

3.2 SWOT analysis

First of all let's look into the inner scope of the SWOT analysis, i.e. into the strengths and weaknesses, in order to be able to adjust the possible opportunities and threats and not to scatter the efforts, see *fig. 1* on page 5.

The strengths

One of the basic things standing for strength is that no special hardware should be required, not the 'new generations' of mobile phones (only a colour-screen of certain resolution, Java-compatibility and a GPRS connection). The users only need a software application to be installed on the mobile phone. What is more, our product does not require constant connection to the internet, which is good because you don't have to worry about poor speed, cost per time unit, etc. In addition, the application is easy to use, considering the fact that it is not overloaded with unnecessary information, which might be misleading and embarrassingly confusing. Moreover, we offer advertising opportunities for shops, which none of our known competitors do. One more thing is the speed of application, as a result of data being stored locally, therefore no constant internet connection is needed, and also, a user does not have to wait for the page to download.

The weaknesses

One of our main weaknesses is that the differentiation might not be so strong that we'll be able to gain proper market share. In this case, in order to be able to compete, there is a need for exact strategy, business plan and vision to react to the fast market changes.
Another thing that can stand for a weakness is limited functionality, which might be not enough to satisfy all client needs. What is more, limited budgeting and no direct marketing experience among the team also stands for weaknesses.

The opportunities

Important thing for a start-up-business is a proper time to enter the market. This would be the 700 years Halmstad celebration – a proper time to promote the service. In 2007 it has been 700 years since the city were granted its privileged letter from the Danish duke, Kristoffer of Halland and Samsö. The city will celebrate this occasion and are planning different activities and festivities in order to, as they put it, "strengthen the locale identity" [2].

Another thing standing for opportunities is the differentiation, i.e. making our product distinct from products offering similar types of services. This would be easiness-to-use, basic information resulting in speed, skins, and to download for free. There is also an opportunity to expand to other cities and perhaps countries. The service could also be expanded with some new features in the future, such as notes related to particular shops, trains, bus stops or other features that the user is fond of.

The Threats

The greatest threat, coming from the outside, is the competitors. Examples of similar services are Google Maps, which are free, other information services and, of course, the ordinary paper map (a full description of our competition is described in *appendix A: Competitors*). Another point of concern is a relatively small market in Halmstad that might be an obstacle when penetrating into the business. Besides, we should pay proper attention to lots of substitutes such as applications for historical events in the city, or simple interactive maps downloaded on to a mobile phone. There are probably more threats but we found it easier to represent them as weaknesses instead.

	POSITIVE	NEGATIVE
EXTERNAL FACTORS	**Strengths:** - No special hardware required - No constant internet connection required - Higher speed as data is accessed locally, not on the internet - Easiness to use, no unnecessary information - Commercials for shops	**Weaknesses:** - Not enough differentiation in order to gain enough market share? - Missing exact strategy and business plan - Limited functionality - Limited budgeting - No direct marketing experience
INTERNAL FACTORS	**Opportunities:** - Right time to enter market - Expand to other cities - Could expand with new functionality - Differentiation from other similar services	**Threats:** - Competitors like Google Maps and Wayfinder - Halmstad is a relative small market

Figure 1. The SWOT analysis of our service

3.3 Five competitive forces

Let's look into the influence from the outer environment. Table 1 represents the competitive environment and indicates the level of influence from small to high. The table represents the five competitive forces that Porter (1998) describes. The five competitive forces are used to determine how attractive a market is. They consist of forces close to a company that affect its ability to serve its customers and make a profit. A change in any of the forces normally requires a company to reassess the marketplace.

Competitive forces	**Small**	**Medium**	**High**
Bargaining power of buyers		+	
Bargaining power of suppliers	+		
Substitutes			+
Competitors			+
Government	+		

Table 1. Five competitive forces

Bargaining power of buyers: The risks are quite small, how big they are depends on the ability to download the application for free (as for the user) and will to advertise (as for the companies and city itself).

Bargaining power of suppliers: The only thing we need for the suppliers is the mobile phone without special requirements (some of the requirement are mentioned before and more in detail later on). Nowadays these requirements tend to be a standard for the new phones.
Influence of the **substitutes** is high as there is quite a big variety of freely 'downloadable' maps, etc.

Competitors: Influence of competitors in the same manner is also big. One of our competitors is the interactive mobile Google maps, which can also be downloaded for free. The Swedish market of mobile maps is not so overloaded, yet influence from outside is rather big.

Substitutes: The substitutes are in this case the ordinary maps that the tourists and citizens usually get from the tourist offices. Our application needs to function as easy as it is to look at a real map.

Government: Influence of government for our project is also a small one, as apparently there are no distinct laws restraining our idea.

3.4 Client

The MAPI application may have the following clients: Shop and service supplying companies, Halmstad city (an interest organization, see *Appendix A: Stakeholders*), and tourist offices. To define all these clients the following questions must be answered: What is the purchasing need of all these clients? What is the potential growth of the clients? What capabilities clients may have related to purchasing needs? Are the buyer's price sensitive?

What are the purchasing needs of shops and service supplying companies? They may want to advertise themselves, when they display their location in the application. These clients, though, may have a complicated purchasing strategy for MAPI, as they may be willing to buy a product only if, as stated by Region Halland, the application has a certain quantity of users (tourists or citizens). The shops and service supplying companies can probably also be considered as slow growing clients; each of them must be convinced about the usefulness of advertising in MAPI, and that is a time costing issue. Second, the application must already have some potential users and this will also require some time consuming activities. Shops or service proposing companies may be price sensitive buyers; it depends on the size of the company. If the client is, for example, "IKEA" or "H&M" etc., it wouldn't be so price sensitive as they are global companies that work on a large market all over the world and they are not so highly dependent on the bargaining power of buyers. Small companies, however, are highly dependent on buyers, so these kinds of clients are probably price sensitive.

Discussing Halmstad city as a potential client, it is easy to say that it is one of most expected client's, as it will have an opportunity to advertise events for the 700 years celebration. The purchasing strategy might be useful for MAPI, as this organization aims to advertise Halmstad as a commercially and culturally attractive city [3]. This project offers what they need: a new way of advertising and displaying the newest information.

It is really important to mention that the 700 years celebration may help to gain more clients such as Gothenburg city, etc. Halmstad city has connections with almost all the stores in Halmstad and it tries to find the best ways to market the city, so it is not price sensitive, as such organizations are prepared to invest more if the bigger capital, to a limit, will be beneficial in the end for the organisation.

A potential client is also the tourist offices. These clients may want to display locations of the tourist offices in the tourist mobile map. Buying strategy of tourist offices is especially beneficial, as it is usually connected to the municipality or other organisations that want to market their business.

Looking forward into an improved application, a new client may be public transportation. The map may have information about where the next stop is located. Considering this future client, it may have a suitable purchasing strategy, as this company is state controlled. This means that the state is probably willing to educate people to use new technologies if they see that the system can be useful for the public transportation.

3.5 Budgeting

When we're describing the budget we're doing it with an open mind. It could be described as a more imaginary approach, but we feel like our ideas are still feasible enough.

Collecting the budget
It is really important to mention the sponsors of MAPI. They are the following:

- Halmstad University is supporting this project with needed equipment: Mobile phones, Project rooms, Computers, software, books, etc.
- "Byggnadskontoret" supported MAPI with needed maps.
- Project members support by allowing to use their's mobile phones, internet pages, free workforce, etc.

If the project evolves further, and a company is created, we hope to get support from Halmstad city as the project can be adapted for the 700 years celebration. During this event MAPI could get free advertisement. Also, if Halmstad city will agree to become the partners of MAPI, there will be additional money for administration of the map.

We also hope that that the tourist offices can get free of charge computers installed; so there will be a possibility for the users to download or update the MAPI application. We are also hoping to get free place advertisement in each tourist office.

Later, when MAPI has some users, we will perhaps charge a fee for advertisement of the shops and other institutions, which are willing to be displayed on the mobile map. They will pay a fixed amount for displaying information in the application. For each new comment added to the map, shops and other institutions will pay a fixed fee.

When users get used to use MAPI, we will charge them for downloading new skins for application or it may be a subscription payment.

Administrating the budget
Sponsor supported budget will be spent on the product development. Equipments will be used in the following way: mobile phones will be used for testing, software and computers – for creating the application, books – for learning missing competence.

80% of money gathered after the project is finished will be used for administration purposes such as paying salaries for workers, payment for internet page storing on the net, administrating the hardware, etc. Only 10% of budget will be used for new functionality development, such as adjusting the application for displaying maps of other cities or displaying information of bus stops or routes. 5% of budget will be used for creation and exploring of the new market. So this part of budget will be spent on commercials or gaining new information about the market. Another 5% of budget will be used for "other expenses" such as bonuses for workers, purchasing new equipments or extra commercials.

Budgetary Reporting
Each month we will probably have to make a budget report. The budget will be analyzed and balanced according to the report. The project will follow this type of reporting in the beginning, as it may occur, that expenses are greater than income. Later, when the project will be stable, analysis of the budget may be done once per half a year.

4. Project administration

Group members:

- Mattias Karlsson
- Mats Lantz
- Simon Svedenman
- Joel Utgren
- Domante Olekaite
- Egidija Charzevskyte

Project leader is Mattias Karlsson and in this project he is mostly assigned to project management. According to Marttalla & Karlsson (1999) these are some areas that the project leader should be responsible for:

- He should know the co-workers needs and motivate them to reach the goals of the project and this will require some social skills.
- Co-ordinate the different phases/activities of the project. The project leader should create a plan that's easy to realize and easy to change.
- Ensure that the project includes all the activities that are necessary for the project to succeed (nothing more than the necessary activities).
- Ensure that the project follows the time schedule. This includes time estimation for the different activities which you should create in a solid time schedule.
- Identify, analyze and react to the risks in the project. This means that the project leader has to identify and take action against risks, if and when they occur in the project.
- Send out the right kind of information at the right time. This requires the right kind of communication tools and planning.

It would be difficult for the project leader to manage all these demands, but this is just an example of how the project leader could work in order for the project to work correctly. The project leader in this group will also put together the documentation from the various work deliverables into one single project document.

4.1 Management procedures

We wanted to have at least one weekly meeting where we all would get together and discuss our progress and ideas, if anyone had some questions they should have been sent in to the project leader at least one day before the meeting. We also had a web page and bulletin board where we could submit material and share ideas. If we look back at how many meetings we had it certainly wasn't a meeting every week and it wasn't as structured as we hoped for. One of the reasons for this was that we worked quite closely together during the 16-17 weeks and we forgot or didn't feel the need of weekly meetings, but we did have a meeting every second or third week. We tried to summarize our meetings and write down what we have discussed and accomplished so we know what we have done and agreed on. If someone couldn't attend to a meeting the information was put on our bulletin board, but we could also send it out by email.

4.2 Management of diaries

Every group member wrote down what they have accomplished during the week and then sent it to the project leader. The weekly reports were then compiled and sent to the tutor of this course, Jesper Svensson.

4.3 Sub groups

The differentiation of the sub groups were changed during the different phases in our system development plan. We are using a model that's called OUP, a full description of the methodology is described later. We felt like this was the best approach at the beginning of our project. There are of course subjects and tasks that everyone should do, mainly tasks that run through the whole project, like documentation and follow the system development plan. You could also call the project management a subgroup, even though there's mostly one person handling that, Mattias. To better understand what the different subgroups have done, their tasks and goals are presented in the different phases that our methodology consists of.

5. System development

There exist many different system development methodologies that a project team could use. In this project we decided to use OUP (Open Unified Process), it's a modification of the popular RUP (Rationale Unified Process) methodology (Balduino, 2005). The biggest difference from RUP is that it's aimed at smaller projects, 3 to 6 people, and that it's much more simplified while staying true to RUP principles (Balduino, 2005). The OUP uses different phases to create iteration template patterns. The OUP have four phases (*inception, elaboration, construction, and transition*) that are usually used. In every phase there are different activities and these activities have different tasks and goals that needs to be cleared, see *fig. 2.* These activities could be customized for each process individually, depending on the specifics of the project. It's also important to classify roles to the project members according to the tasks that need to be cleared.

Iteration template patterns	Phase objectives
Inception Phase Iteration Manage Iteration Initiate Project Manage Requirements Determine Architectural Feasibility Assess and Plan Next Iteration	▪ Understand what to build ▪ Identify key system functionality ▪ Determine at least one possible solution ▪ Understand the cost, schedule and risks associated with the project
Elaboration Phase Iteration Manage Iteration Manage Requirements Define the Architecture Develop Solution (for requirement) (within context) Validate Build Assess and Plan Next Iteration Manage Changes	▪ Get a more detailed understanding of the requirements ▪ Design, implement, validate, and baseline an Architecture ▪ Mitigate essential risks, and produce accurate schedule and cost estimates
Construction Phase Iteration Manage Iteration Manage Requirements Refine the Architecture Develop Solution (for requirement) (within context) Validate Build Assess and Plan Next Iteration Manage Changes	▪ Iteratively develop a complete product that is ready to transition to its user community ▪ Minimize development costs and achieve some degree of parallelism
Transition Phase Iteration Manage Iteration Develop Solution (for requirement) (within context) Validated Build Assess and Plan Next Iteration Manage Changes	▪ Beta test to validate that user expectations are met ▪ Achieve stakeholder concurrence that deployment is complete

Figure 2. The different phases that is available in the OUP methodology

When the iteration template patterns are put together (the different patterns will iterate multiple times) we have a delivery process and this delivery process describes a complete project lifecycle. There are some questions that one should try to answer before it's time to move on to the next phase. These questions are important to answer in order to understand if it's necessary to make another iteration of the phase. All of the above statements we feel are something that our project will benefit from. The ability to engage in coding, testing and possibly user feedback early on in the process is essential to us in order to identify problems, flaws and technical boundaries in our concept. By doing this as early as possible we have the opportunity to modify our concept to better fit with technology constraints and user expectations.

We feel that our decision to use OUP as a development methodology is very much based on the fact that the process and the requirements can be refined as the project goes along. Neither of us have extensive practical experience in using a methodology. This lack of experience together with differences in daily schedules and the fact that many of us have never met before speaks for an agile but still relatively formal methodology. As an alternative we have examined extreme programming. Though this process includes many of the values we find important in system development we lack a formal framework to rely on. In this project we find it suitable to use an agile methodology while at the same time having a clear description of the process to fall back on in case of the eventuality that we wouldn't know what to do next. Like Balduino (2005) and Kruchten (1999) state; the trademarks of OUP/RUP is the many iterations and how you constantly are trying to evolve the project with use cases and diagrams and this is also why we think that this methodology will suit us in our development process.

6. Inception phase

In the inception phase it's important to achieve concurrence among all stakeholders on the life-cycle objectives for the project (Kruchten, 1999). We don't have stakeholders in the same sense as other projects, this is after all a school project, but we have them as fictional stakeholders so it's still an important phase and we contacted Halmstad municipality for some feedback and to see if they are interested in this idea. Kruchten (1999) says that the main artefact should be:

- A vision document - General vision of the project's requirements, key features, and main constraints.
- A use-case model, which should list all use cases and actors that can be identified in the early stage.
- An initial risk assessment.
- A project plan, this should show the phases and the iterations.
- An initial business case.

This could of course differ from project to project, but could be the outcome of the inception phase. We created the business plan (which is covered at page 3), although the business model could be considered, according to Balduino (2005), almost useless in the OUP methodology. We also consider the project plan as this whole document (including the appendixes, especially *Appendix B: Time Schedule).* The early vision document and the use case models and the initial risk assessment are more thoroughly covered in the following segment. The subgroups we have created in this phase are connected to three main tasks; *the feasibility study, the system requirements, and the risk analyzing*. There are more artifacts in these three but those are the main three tasks that we divided our work in.

Feasibility Study

In the feasibility study we tried to find all the information that was necessary to start our project and in doing so we formed different subgroups that could search for different information. This is how we divided ourselves:

Stakeholders: Mattias, Joel

Their task was to find out more about which end users and companies could be interested in this service and what added value this service gives them. This is somewhat described in the business plan but it's fully analyzed and described in *appendix A: Stakeholders.*

Technical Issues: Simon, Mats

They were responsible for finding out more information about what technology and mobile phones are realistic to use when developing our product. The technology includes different programming languages, databases and platforms.

Software issues: Doma, Ega

This group tried to find out more about pros and cons when it comes to, for an example, a web service VS a java application in the map mobile sector. It was also important to recognize how the competition have implemented similar software in the past and see what their biggest problems were, if there was a problem with the size of the software etc. There is also a more detailed description of this in *appendix A: Competitors.*

Project Plan: All
This is not differentiated in subgroups; we all decided how to use the system development methodology and planned the different phases and tasks in a time schedule.

System requirements
All the information that we found in the feasibility study were then put together in our system requirements. The subgroups weren't that different from the feasibility study. We all presented our results and then tried to make the final system requirements together and/or in the same subgroups as before.

Risk analyzing
The risk analyzing was put together by the project leader, Mattias, with the assistance of the other project members.

6.1 Feasibility study

To first find out what's achievable and what's not achievable in the project, we had to do a feasibility study. According to Sommerville (2001) this is an important stage and all projects should start with some kind of feasibility study. This is one of the activities we have put under the inception phase. It follows the basic objectives of the inception phase, to understand what to build and identify the system functionality. We looked at which stakeholders could be interested in our vision and project, it was very important because we wanted to discover what stakeholders wanted to implement and how we could market this service to them (possible stakeholders is identified in *appendix A: Stakeholders*). After we did this we tried to search for what exactly we could and wanted to implement that wouldn't take more time than the time span of the project. This includes what kind of mobiles and mobile technology programming language, communication technology etc. we could use.

It was difficult to find a common denominator, but we wanted to use phones that were released in 2004 as our lowest common denominator. By searching developer sites, like SonyEricsson [4] and Nokia [5], we decided that we wanted to use the programming language J2ME and that we wanted to have a phone that didn't have to support the new java MIDP 2.0 specification, we found that it's functionality could be useful but not necessary when creating our application, so we used MIDP 1.0 instead. This early collection of data was a first step towards recognizing what we should build and how we should build the project, and the interpretation of the information was put into our system requirements.

We identified and suggested three different platforms for the whole service; *the user portal*, *the administration platform* and *the mobile platform*. The different requirements for these platforms are discussed in the next segment. We also made some use cases to better understand what functionality we could get from this. The use cases are quite simple and are something that helped us in our process (especially when forming the requirements). The use cases are mainly concentrating on the mobile platform and how it could and will work.

UC1 The mobile updater
1. The user accesses the web portal on his / her mobile phone using a Bluetooth- and internet enabled PC.
2. The user can then choose to download the application or to update the application.
3. If the user moves out of range from the transmitter it must be possible to revert to the old information that is not updated.

UC2 The interactive updater

1. The user starts the mobile application while in the city, not having access to a PC.
2. The application asks the user if the client database should be updated.
3. The client connects to the central database using GPRS.
4. The client uses time stamps to update only the necessary information.
5. If the connection is broken it must be possible for the client to perform a roll-back reverting to the old database.

UC3 Money maker

1. The user feels the need to withdraw some cash. Since the user is new in town he / she have no idea where to find an ATM.
2. The user chooses to view only banks and ATM machines in the client application.
3. On the map banks and ATM machines are shown as clickable icons.
4. When a user clicks on an icon information about the bank is shown, such as the name of the bank, opening hours and if foreign currency is available.

UC4 Feed the hungry

1. The user gets hungry and wants to know where the nearest restaurant is located.
2. The user chooses to open the application and view the restaurants located in the area.
3. The application points out different restaurants on the map, as clickable icons.
4. When the user clicks on the icon he/she is interested in the information of that particular restaurant is shown.

UC5 The shopaholic

1. 19 year old Felicia is new in town and interested in what shoe stores Halmstad has to offer.
2. She downloads the application from the web page and uses it.
3. She chooses the shopping skin and gets a map showing all the shops in the area represented as little icons.
4. She then chooses an icon from the map and gets all the vital information the shop has entered, including sales and offers.

6.2 System requirements

After making the initial feasibility study we made a deeper elicitation and analysis regarding our requirements. This involved some prototyping to understand if the technology we wanted, and expected to use was functional for our project. We also looked more at the competition in order to better understand how they implemented their mobile maps and how we could distinguish ourselves from them. When this testing was done we started documenting our system requirements. Kruchten (1999) describes a requirement as a condition or capability to which the system must perform. Kruchten (1999) also separates the requirements into two main sets; the functional and non-functional requirements. The functional requirements specify the actions the system must be able to perform and the non-functional requirements are related to the end-user.

We have also sorted them out in these two sets. The functional requirements are usually easier to confirm than the non-functional requirements (Sommerville, 2001). We think that one way to solve this is by using regular testing and prototyping. The requirements we present have also been changed during our iterative development process, something that we will show in our coming phases. This change made the requirement document to grow in size so we only describe the user scenario for every platform in this section (all the requirements are shown in *appendix C: Mobile platform; Administration platform; User portal).*

6.2.1 Mobile platform

The user first connects to the web page where the application is stored. This is done via the GPRS and WAP. The user downloads the map application to their java compatible mobile phone. The java application is stored in the free memory of the phone. When the user starts the application he/she can look at the map of the city or update the skins. The application asks the user if he/she wants to update every time the user starts the application. When the user first downloads the application there will be no skins installed, this has to be downloaded from the database. The information is accessible to the end user by connecting the java application via GPRS/WAP.

The application connects with the SQL Server and checks if there is any new information to download. If there is any new information on the updates the user will be asked if they want to download the new updates. The user can navigate the map and zoom in and zoom out to get a better view of the map. The user chooses a skin from the available skin list in the menu. The user can't have more than *one* skin on the screen at the same time. The skins show icons on the mobile screen and the icons are showed by colors. The user can navigate between these icons and when an icon is selected relevant information is represented about the object.

6.2.2 Administration platform

The client (stores/tourist offices) sends in information to the database by connecting to the web server. To connect to the web server, the client needs to log in with the necessary password and login name to send in the information. To easier transfer the data to the database the client has to fill in a data form. There is also a map where the store/company could pin point the location of the store on a similar map that's used in the java application. The information is maintained by the system administrators, who will have to accept the clients and maintain the information that the clients put in to the database.

6.2.3 User portal

A web page where the user can download the application to the java enabled mobile phone. This page is separated from the administrative platform and the updates. On this web page the user can look at a demo of the application and test the basic GUI of the application to get more familiar with the system. On the server there are two separated files, a JAR file and JAD file. On some phones the JAD file is necessary; otherwise the phone won't work correctly with the application. The files could be downloaded to your computer or to your mobile phone directly. If the files are downloaded to the computer the user will have to transfer them with Bluetooth, IrDA, or serial cable. The user downloads the application by using GPRS and to make this simpler for the user, the user portal will also have a WAP page where the links to the files are shown.

6.3 Risk assessment

There are always risks in a project and it's usually necessary to identify these risks so that they can be managed. If a risk, for some reason, happens there have to be some back up plan to minimize the risk so that it doesn't damage the project anymore than it already has. For this we need to first identify the potential risks and examine how big the risks are, make a risk plan on how to minimize the risks and finally how to overview the risks. Our risk management is following Sommerville's example of how to structure the risk analyzing (Sommerville, 2001).

Instead of describing all the risks we have identified (see *appendix D: Risks)* we will instead describe the most catastrophic risks, if they were to occur, that we have identified:

- The j2me application is too big for the mobile phones we are using.

Solution: Restrict the number of POI (points of interest) your application could have and bring the quality of the map down.

- The j2me application can't communicate with the database correctly.

Solution: The updates will not work; the themes and skins have to be stored within the application.

- Inexperienced people, people who don't have enough skills to accomplish the tasks that we need.

Solution: Get help from the teachers and the tutor.

7. Elaboration phase

The elaboration phase is sometimes considered to be the most critical phase in the RUP process; it's the phase that take care of the hard "engineering" (Kruchten, 1999). When this phase is finished the architecture, requirements, and plans should be stable enough and the risks should be moderate. Usually lot of iterations are happening in this phase and it depends on the size and scope of the project when deciding how much iteration there should be. According to Kruchten (1999), the outcome of the elaboration phase should be as follow:

- A use-case model (at least 80 % finished) where all use cases and actors have been identified.
- Complementary requirements that capture the non-functional requirements and requirements that are not associated with a particular use case.
- A description of the software (system) architecture.
- An executable architectural prototype
- A development plan for the overall project, showing the project plan and the iterations.
- A preliminary user manual.

These activities aren't that different from what Balduino (2005) suggests that the developers should try to accomplish during this phase in the OUP methodology. The user manual is something we'll describe in a later phase. The complementary requirements are already documented in *appendix C: Requirements*, but these are some of the requirements that we added in this phase.

Mobile platform

Technical

1.3 At least 3 Mb of internal memory and the application should be within 1mb
1.4 An apache server that runs the Servlet that connects with the database

Functional

2.1 Scroll between all the points of interest
2.2 Keywords to find the right skins
2.3 Change the language of the application

Non-functional

1.2 The same commands and functions should be accessible on different mobile phones
1.3 Many users can update at the same time
1.4 The update should not take more than 15 seconds
1.5 It shouldn't take more than 5 seconds to scroll on the detailed map

Administration platform

Functional (for the clients)

1.1.8 Register Mail
1.1.9 Register the x and y position of the event on a map
2.1.6 Register max 400 characters in the comments

Non-functional (for the clients)

1.1 Portability; it should look the same and work on as many browsers as possible
1.2 The clients should only be able to log in to their own account

User portal

Functional

1.2 Use a demo of the J2me application

Non-functional

1.1 Easy to find and download the application

1.2 Portability; it should look the same and work on as many browsers as possible

We sorted the subgroups in three big sections; *System architecture*, developing initial *prototype* and *test and validate*.

System Architecture

Mobile platform: Mats, Simon

They prototyped and designed the mobile application with the help of UML and flowcharts.

Administration platform: Joel, Mattias, Ega, Doma

Created class diagrams of the database, it's important to show all the objects, attributes and keys.

User portal: Mattias, Ega, Doma

They showed a simple design of the web page that will host the map application. Later on a more advanced version (a hi-fidelity prototype) of the functionality and GUI of the J2me application was created.

Develop initial prototype

All members of the group where involved in this process. The idea was to develop a simple java application, maybe just an application with a map that could get access to our database. The tables were almost completed, but it was more important to establish joints between the tables and the application.

Test and validate

Validate build: Mats, Simon

They made a simple functionality test to check the basic functions of the system on different platforms, e.g. different mobile phones.

Usability testing on design: Mattias, Mats, Ega, Doma

Made a cognitive walkthrough test on the GUI of the mobile application.

7.1 Software architecture

When we know our requirements we can create a more advanced version of our software architecture. According to Sommerville (2001), an architectural design process is concerned with creating a basic structural framework for a system. The architectural design should create a special architectural document that contains graphical representations of the system models with related descriptive text. It will describe how the system is structured into sub-systems and how each sub-system is organized into skins. The whole system architecture is shown in *appendix E: System architecture*, the different sub systems is described in the following section.

7.1.1 Mobile platform

The mobile platform is the J2ME application that runs on a mobile phone. To be sure that it will work correctly with the database and the administration platform (in some way also the user portal) we created an early flow chart, an initial class diagram, and a state diagram of the j2me application. The early flow chart can be seen in *appendix G: Early flow design of the J2ME application.* The flow chart is an early prototype of the mobile platform and was created with the use cases in mind (the use cases are described at page 15). The flow chart is perhaps not that much affiliated with the elaboration phase, it was created in an earlier phase to represent a first look of the J2ME application. The class diagram is missing a lot of detail but we had, in this stage, identified four major classes that we could build our application on; *the GUI, the map, the PersistentStorage, and the ServletConnection*. Some of the small classes we have created so far are shown in *appendix H: Initial class diagram of the J2ME application.*

We made a more complete state diagram of the GUI to complement the flow diagram; we made this because we wanted to show how objects change their state in response to user input, see f*ig. 3*. Schmuller (2001) says that this is useful to use when characterizing a change in the system, in this case, a change in the mobile platform. The state diagram shows the starting point and the end point of a sequence of state changes (Schmuller, 2001). Our starting point is before the application launches, it's a common place to start.

The state diagram is divided into two big areas. You have the state of the objects that are connected with the main menu (the end point is also connected to the exit object) and on the other side we have got state and objects of the overview map and the detailed map. We show some commands that the user will have to press in order to get to the other objects, like pressing the arrows or the 2,4,6,8 number keys to get to the state "move the pointer".

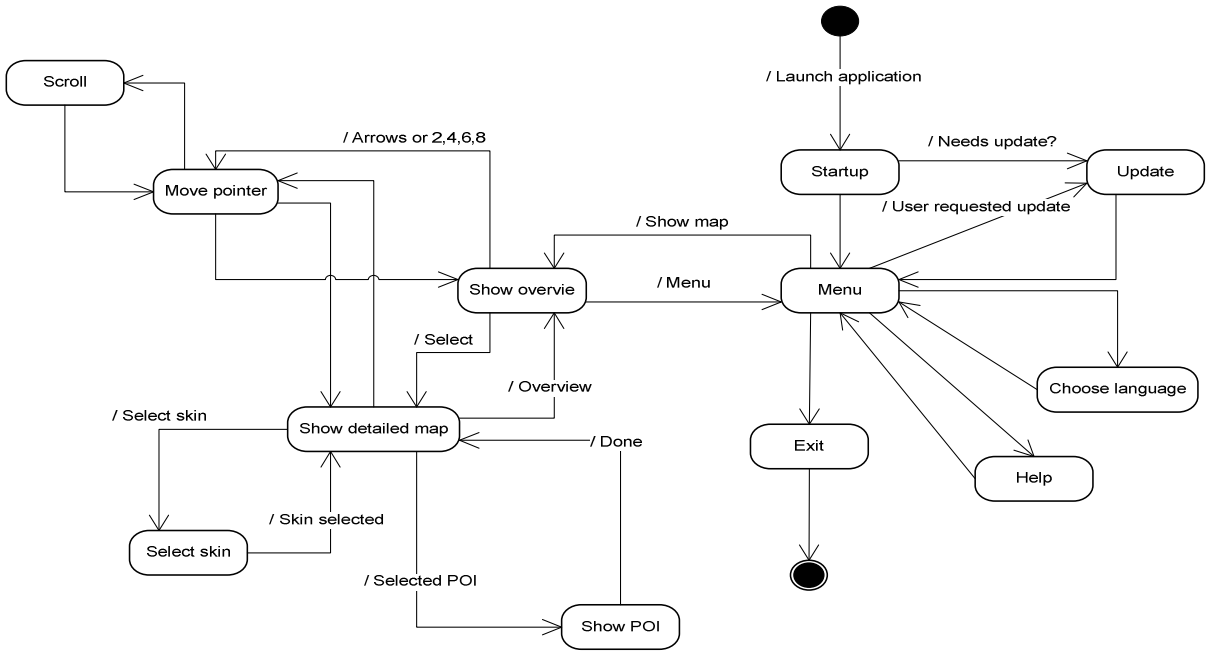


Figure 3. Initial state Diagram of the mobile platform

When making all these diagrams we also made an early paper prototype of the GUI of the mobile application. This was an early prototype of what we wanted it to look like and how the interaction with the mobile application could function (showed in full with a lengthy description in *Appendix I: First prototype of the GUI*). It may not be an architecture that shows the different skins as a state diagram, but it's definitely connected to the state diagram and its architecture and this is one of the reasons why we think it belongs in this section. Later on, as can be seen in the testing and validation activities, we also tested this GUI with the help of some user interface methods.

The prototype was first, and most, created with our own idea in mind and some of the knowledge we have from usability engineering. One of our guidelines, when creating this interface, was that it should comply with Shneiderman's and Plaisant's eight golden rules (Shneiderman & Plaisant, 2005). The eight golden rules are principles to use when making user interfaces. These principles are quite simple, but they are a great platform to stand on when you start designing a user interface. Even if our use of the principles were used as a guideline, it was still something that made our decisions easier to make. These eight golden principles can be summarized in eight bullet points (Shneiderman & Plaisant, 2005):

- Strive for consistency.
- Enable frequent users to use shortcuts
- Offer informative feedback.
- Design dialog to yield closure.
- Offer simple error handling.
- Permit easy reversal of actions.
- Support internal locus of control.
- Reduce short-term memory load.

We believe that it's important to strive for consistency and offer the user informative feedback. These were our main bullets when creating the GUI, but we also had the rest of the six bullets in mind when creating the GUI. These eight bullets were, as we already have stated, guidelines. In our final design we will also describe in more detail what and how we used other usability references to create our GUI and J2ME application.

7.1.2 Administration platform

The first page on the web portal is a login page. This page is start page both for the system administrators and the clients. The page contains a logotype, login box, password box; and a link for new clients to register their shops in a web form. There is also another link that contains a form where they can put their names and their password will be sent to them, if for some reason they have forgotten it.

The system administration page contains functions for the system administrators to get information about clients, shops, comments and events that the clients submit to the database. The system administrators will have to create new clients and then submit the information that the clients requests. This is the case when the clients first register. They can also decide to delete some comments, if they are inappropriate, and list the clients that are available in the database.

The client page contains a function to put in comments related to the shops into the database. The clients have to put in information when the comments will start, stop and the comments for the shop. Another function is to update the information about the shop. Attribute to update can be name, address, opening time, contact person, phone mail, x and y, and what event/business they. The last function can be used by the tourist office and their subsidiaries. With the web form clients, like the tourist office, can submit information about events that they want to be showed in the service. Information they put in the Web form is date, time, event and description. By doing this, they can register a new event (could be a temporary event) without registering a new shop or client name. *Fig. 4* shows our initial structure, it could have changed a little bit in the final version but the design is almost identical to this structure.

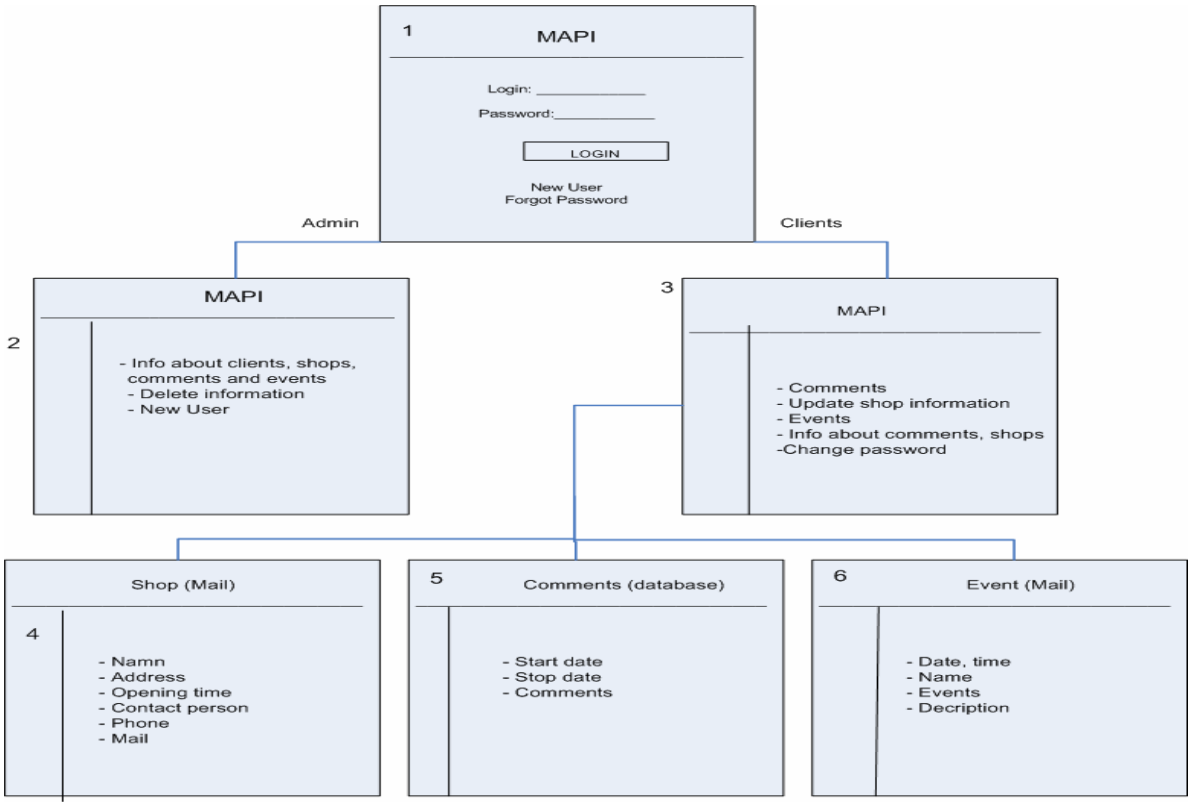


Figure 4. The structure of the administration platform

The database that we then store the information in has severable tables; the prototype of the database includes main tables and their main attributes. The tables are created from both MS SQL and ASP.NET environments. Tables on MS SQL are created by hand, and on ASP.NET – automatically. Automatically generated tables are related with the clients and their logins/password related information (the tables have 'aspnet_' beginning in front of the names). These are the following: *aspnet_Users, aspnet_Applications, aspnet_Profiles, aspnet_Membership, aspnet_Roles, aspnet_UsersInRoles, aspnet_SchemaVersions.*

Table *aspnet_Users* is the connection point between manually created database tables and the ASP.NET tables. The prototype consists of 12 tables – we have 5 that are created manually and 7 that are created automatically. The manually created ones are: Shop, Object, Comments, Objects and shops, and Events (see *fig. 5*). Table *Shop* represents data related to shops that belongs to certain client. Attributes representing shops are the following: Name, relevant contact information and position of the shop in the map, by x and y coordinates, opening hours and address etc. Table *Comments* is related to a particular shop, which has information about the advertisement of a shop (attribute Comments), that can be left/updated by a registered client. It also possesses start and stop dates related with a particular comment. The attribute UpdateTime (for the administrators) indicates the latest update of a certain comment.

Table *Object* contains data on objects, i.e. products, sold in a particular shop, like shoes, clothes, services, etc., or a service, like tourist information, and an attribute representing an icon for an object. Table *Events* holds information about events happening in the town, like sport events, concerts, etc. The attributes of this table is Name, Address, Start date and a comment of the event. It also holds (in the same manner as Shops) X and Y coordinates of the map to represent its location.

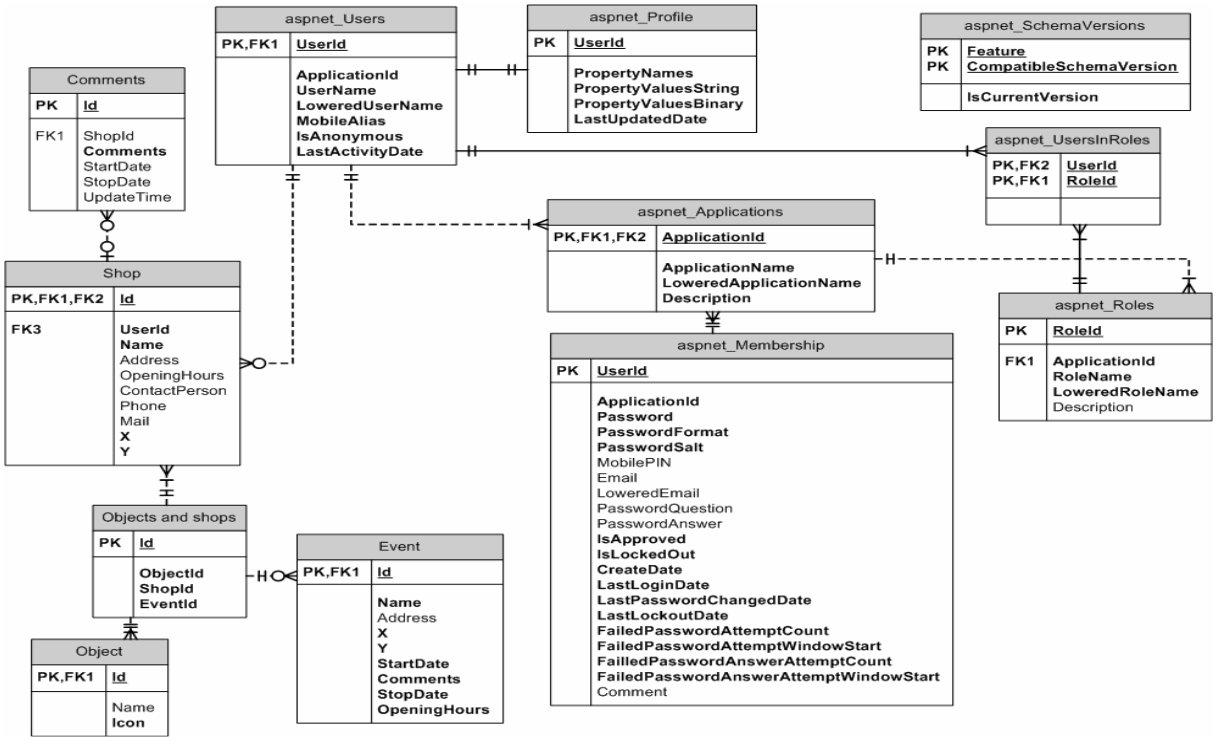


Figure 5. Database prototype: tables and relationships

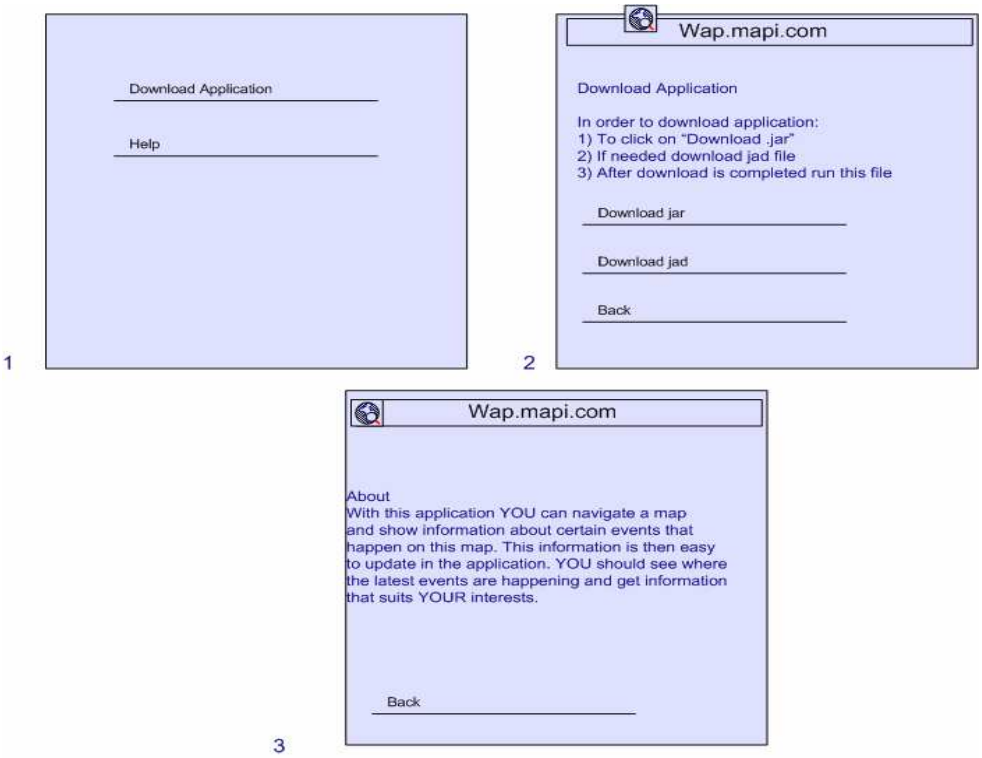
Talking about the relationships, a single user (client) may own several shops, which is represented by one-to-many relationship. One shop in turn might have many comments which can be updated. One shop can also have several objects, i.e. products sold (relationship one-to-many). And a certain object might be sold in several shops, that is, we get a many-to-many relationship. A tourist office is a particular instance of a shop, which also might have several instances, and provides tourist information (standing for a service in *Object* table). It can also add information about certain events. This is why we need an additional table, objects and shops. It relates shops to objects and events and vice versa. That's why we have one-to-many relation with the table *Objects* and one-to-many relation with the table *Events*.

We will show objects via the skins on the map, i.e. a user will be able to select a single object to be displayed on the map, represented by a certain icon. Events can also be shown in the map. A default icon is connected to events (default – not taken from the table). *Appendix F: Table code and restrictions* shows what table restrictions and table code were created to better comply with the above information. These tables are the manually created ones.

7.1.3 User portal

The user portal may not be as big as the rest of the components, e.g. the administration platform and the mobile application, but it's still important for the overall success of the service. The user portal has two customized web pages, one for the ordinary web browser and one for the mobile, a wap page. The main difference between the wap page and the standalone page is that the demo of the java app won't be used in the wap page. It would probably be to slow to load if we're going to use a flash/java app in a wap page. The pages have three main links; we characterize them as 'download application', 'DEMO' and 'Help'. The download page is, quite obvious, the most important one. This page shows that the user have to click on download jar and download jad to get the application on to the mobile phone.

The 'Help' link speaks for itself. It's where the user can read about how you're supposed to download the application and store it on the mobile phone. The 'DEMO' page will only be used on the web page and with this demo the user can interact with application as it will be seen on the mobile phone. *Fig. 6 show* how the architecture of the wap page will look like and *Appendix J: User portal design/description* describes our simple, but yet functional, design in more detail. Its purpose is to show the connections not the GUI.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Download Application
In order to download application:
1) To click on "Download .jar"
2) If needed download jad file
3) After download is completed run this file
Download jar
Download jad
Back
2
Wap.mapi.com
About
With this application YOU can navigate a map and show information about certain events that happen on this map. This information is then easy to update in the application. YOU should see where the latest events are happening and get information that suits YOUR interests.
Back
3

Figure 6. The three different screens of the wap page for the user portal

7.2 Test and validation

When we're talking about testing and validating the system, we're mostly talking about, in this early phase at least, testing the GUI of our system. We're also validating our system and code, and this is important because our requirements are constantly changing during the project. According to Sommerville (2001) the validation and the verification of the system is important to understand; we need to know if we're building the right product and if we're building it correct. In this early testing the J2ME application is the main part of our test, but other parts of the system is also important to verify. In order to test the GUI we'll first need something that we could test and this is where we use our early GUI design of the J2ME application as our test platform.

7.2.1 Usability testing on design

When making our early GUI test, we first thought about doing a cognitive walkthrough and a heuristic evaluation, but in the end we just did the former test method. The tests are quite similar, but they have different agendas and goals. When testing the GUI on paper we thought that it was best to use one of these tests. The reason for this was that we made only a low-fidelity prototype (you couldn't interact with it) and the time constraints made us just chose one of these tests.

The cognitive walkthrough was tested by the members of the project team and one of the characteristics of the cognitive walkthrough is to use it when a system developer wants to establish how easy a system is to learn; you learn through exploration (Dix, Finlay, Abowd & Beale, 2004). We thought that this test complied more with our expertise in the area, e.g. this evaluation is more dependent on usability experts, something that the informatics students in the project can say that they to some extent are. Kjeldskov et al. (2005) have tested and used different evaluating techniques that one could use when testing the usability of a mobile guide. They discussed and tried tests with both expert evaluators and end-user evaluators. Kjeldskov et al. (2005) recognize that there could be some problem with not using the end-users but they also say that the expert evaluators are perhaps more useful to use when testing in an early phase.

To do this test we first came up with a task that the evaluators should try to perform on the system. According to Dix et al. (2004) this task should be a representative task that most users will want to do. Our task was: "Download and update the skins and show information about a grocery store that resides in the centre of Halmstad and then show the other grocery stores in the area left to the centre". We then wrote down a written list of the actions needed to complete this task and created same paper designs to represent the actions, see *fig. 7 on page 26*. When doing this test the evaluator went through all the actions and with every action completed the user answered four questions. These four questions and all the actions, and a more fully description of the test, is described in *Appendix K: Cognitive Walkthrough test; The test subjects; Failure document*.

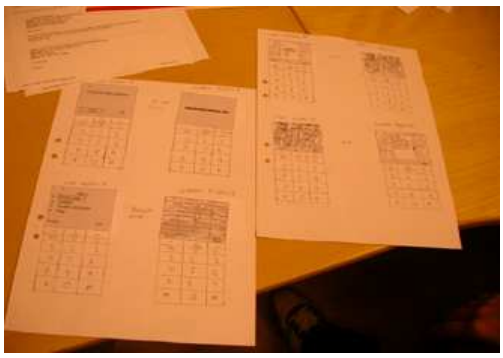

Figure 7. Actions created

We found many flaws with our design, we didn't expect it to be flawless, but it was mostly design issues that the user would have problems understanding. The evaluators experienced problems with how some words/functions were phrased. They, for example, recommended that the 'update' has to clearly state what the user is updating and that the update is successful. There was also some controversy on how the user would know where certain places reside in Halmstad. This could be fixed by drawing out landmarks or something similar on the overview map, and perhaps also on the detailed map. Other problems related to how the skins would be activated.

Almost everyone agreed that the 'skins' phrase could be misunderstood and that it should be changed to something else. The user shouldn't have to press 'accept' and then 'show' to change skins. This was a problem with our early GUI design, something we have already changed with the 'show only one skin at a time'. We also discovered some navigation issues and we got some feedback on how we could solve these problems. There was some discussion, that didn't have anything to do with the questions at hand, if a main menu was really necessary. It would perhaps be easier for the user if the overview map was shown directly with a pop-up menu instead.

We also discussed how you would scroll in the detailed map i.e. how fast and what feedback the user should get. All the evaluators agreed that turning off the 'pointer' was not a good idea. There were also some great ideas that we would want to implement, if we have the time, like having a help screen on every new screen and scroll between different events in a skin and showing where they are on the map. One problem with the test was that we used two people, Doma and Ega, which was involved with the creation of the first GUI design. They didn't discover as many new unique problems as the third evaluator, Mats. After this test we made a new GUI design on paper to show what has changed. This is also shown in *appendix I*: *Second prototype of the GUI*.

7.2.2 Validating build

The software testing, verification and validation that we used with the J2ME application in this stage of development were extensive but still simple enough. Like the GUI test it was important to check if the application met its specification and if it does what it's required to do, according to the requirements. We could at this point confirm if the database worked correctly with our workstations and our mobiles. We had three, four different kinds of mobiles that we could test our application on and these mobile phones were either a Sony Ericsson mobile or a Nokia mobile.

The first test was just to see if the application could get a connection with the database on all our test devices. These were some of the requirements that we tested and wanted to get feedback on:

- A java enabled phone with a color screen and enough free memory
- Establish a connection with the database

When we did the first test we discovered one main problem with the application. We couldn't get access to the database on the phones; it only worked in the emulator on our workstations. The problem was that we couldn't access the database outside the school network and in order to make this work correctly on the mobile phones we needed to create a database interface between the application and the database. We solved this by adding an apache server that runs the Servlet that connects to the database and in order to get it to work with the mobile application we had to get permission from the University's computer administrators.

We also tested how much the RMS (record management system) could store e.g. how many of these 'POI' our different mobile phones could store in the flash memory (where you store data permanently). We found out that the RMS size you could use was various depending on the different mobile phones used. If we wanted to use it on the Nokia mobile, and this was a priority for us, the RMS size was only 63 Kb. This could be a problem if one 'POI' had a size that was bigger than 1KB. We discovered that 500 characters of information were probably enough for one 'POI', by putting up a restaurant's week menu, the largest information we could think of, and this information totalled to about 0.5Kb. This means that, if we look at the limit that our Nokia test mobile has, we only can store about 120 POI in the RMS. This could be enough for a city like Halmstad but in the future you would have to find another memory storage if it needs to work on as many phones as possible.

The RMS test was important, in order to see how much space the point of interests would take on the mobile phone, but we also had to check if the map was too big for some mobiles and if it was visible enough on the different models. We had to consider screen size and quality when we tested this on the different mobiles. This was a very iterative procedure. The mobile phones have different resolution and they also have different capacity when it comes to DPI (dot per inches). Therefore one mobile could display a bigger part of the map than another model. The maps that we used, by courtesy of "byggnadskontoret", were quite detailed and the size of the map was also quite big.

We found that a 128x160 resolution screen was the minimum requirement that the user should have to display the map on their mobile. We also found out that in order to get it to run on, for example, the Nokia phone we had to resize the map and also change the colour depth to a much lower value. In the end it seems that we would have to change our max mobile application size to 1Mb. This will probably discard the Nokia mobile, which has a max jar size of 500Kb, but we will continue to try to downsize the map without losing valuable quality.

8. Construction phase/Transition phase

The construction phase is where all the bits and pieces are developed and integrated into one product (Kruchten, 1999). According to Balduino (2005) the developers iteratively develop a complete product that should be ready for transition to its user community. This was also our idea with the construction phase, to develop a nearly as finished version of our product as possible. But before you can do that, Kruchten (1999) says that you'll have to finish some activities that usually reside in this phase:

- The software product integrated on the adequate platforms
- The user manuals
- A description of the current release

We also decided that the transition phase, where Balduino (2005) feels that it is important to beta test to validate that the user expectations are met, could be paired with the construction phase. We felt that there wouldn't be much iteration in the final phase (transition phase) so instead we decided to pair it with this phase.

At this stage of development the subgroups were almost automatically sorted out. The work agreement was already established and our abilities and expertise wasn't about to change drastically during this phase. We sorted the subgroups into the following sections and tasks; **Final design, Final testing and validation**

Final design

Mobile platform: Mats, Simon, Ega, Doma

They continued to make the application more final by creating code and classes that didn't exist before. This included the menus and the map functions and getting all the information from the database stored in the application.

Administration platform: Joel, Ega

The whole administration platform with the client pages and the system admin pages were created. This means the web page where the clients could log in and save the stores and events and where we, as system administrators, could help the clients with the registration.

User portal: Ega, Doma, Mattias

They created the final version of the user portal; this involved the wap page and the web page that were then put up on our server.

Final testing and validation

Validate build and usability test: Mattias, Joel, Mats, Doma

Make a full validation and verification of our system. This was important acceptance test, beta test, so that we could see if it complied with our requirements.

8.1 Final design

During the final design we tried to code and implement the final functions that would make the system complete. In this final design the functions were slowly coming together and it wasn't until the end that we really could implement all the functions for the different platforms. The following subsections will show how every platform evolved in the final stage and we'll also give a description of the current release.

8.1.1 Mobile platform

When we programmed our application we knew some "basic" functions that we wanted to implement, but we underestimated how long these functions would take to implement. It was a tedious and iterative work that almost directly was behind our time schedule, we therefore had to work overtime the last two-three weeks to make the functions work correctly. We were determined to get it to work correctly before we ended the project so that we would still have time to do some testing.

The J2ME-programming was mainly done by two team members, and because of that most of the communication during the construction face was conducted in an informal verbal manner. Still the workload was divided using a simple top-level description of the applications most important packages. First in the final stage of the process the code and each individual class was documented in detail, see *Appendix H: Final class diagrams*.

Development platform and tools

The mobile J2ME application is developed on the windows platform using Sun microsystem's Java Wireless Toolkit 2.5 [6] which requires Java SE SDK, and the Eclipse IDE [7] with the EclipseME plugin [8].

We initially used Sun's own IDE, Netbeans in combination with the wireless toolkit, but eventually replaced it with Eclipse due to its unresponsive interface. Though Netbeans works "right out of the box", Eclipse and EclipseME feels more responsive once configured correctly. This means that we avoided one of the initial risks that we found during our elaboration phase. EclipseME is a plugin for easy integration of the wireless toolkit in the Eclipse IDE, but it still needed some configuration [9].

Our application stores the images used to compile and display the map in the jar file. To keep the jar file as small as possible we used the obfuscator ProGuard [10], and the PNG-optimization tool Pngout [11]. All image manipulation and creation was done in Adobe Photoshop. The code was documented using javadoc [12], and the diagrams were created using Microsoft Visio and Star UML [13].

During the whole process the application was tested and demonstrated on the emulator provided in Sun's wireless toolkit and the hardware devices listed below.

- HTC P3300, PDA phone
- Nokia 6111, mobile phone
- Nokia N70, mobile phone
- Sony Ericsson, K750i, mobile phone
- Sony Ericsson, T630i, mobile phone
- Sony Ericsson, Z800i, mobile phone

Implementation

The main classes continued to grow and it became apparent that our original main five classes wouldn't be enough; we had to both expand and delete some of the old ones. One of these classes was the update function and the first thing that we want the user to do is updating the application in order to get all the latest information from the database. In order to update the data that needs to be stored on the mobile device we needed to establish a connection between the J2ME-application and the server. This function can be described as a three layer architecture, where we have an apache-server in the middle running a servlet that is responsible for fetching the data requested from the database and send it back to the mobile-application (see *appendix E: High level system architecture).*

The servlet on the apache-server is configured not to interact with the database before it has received a valid username and password from the mobile-application, these values are predefined in the software and transmitted in the background without the need of user-interaction. When the servlet has been successfully connected to the database, it starts to send SQL-queries and stores the answers in a text-string that is finally sent back to the mobile-phone, which in turn stores the data in the handheld device's persistent memory. This means that the application downloads everything to the handheld and the sorting process is done by the application.

After the update is finished the application will show the map of the application, where we have the overview map as the standard choice. Early research and design discussions of the map involved what image format we were going to use and we made a comparison between the use of vector- or bitmap graphics. The application should be able to display the map in absence of an existing connection to the outside world; therefore the map needs to be stored within the application. Vector graphics would probably be less space consuming and decrease the application size. At the same time a vector implementation would increase the size of the code, and also be much more time consuming to write. Possible libraries for implementing vector graphics are amongst others the optional package JSR: 266 [14] and TinyLine [15]. Both 3rd-party packages are able to load, display and manipulate content in the SVG format (scalable vector graphics) which is an open standard for vector graphics set by the W3C consortium [16]. Our final decision to implement the map using bitmap graphics is in large due to the fact that vector support isn't yet implemented in the standard development distribution of J2ME, and also is too time consuming to implement for the scope of this project.

An always present concern of ours, were not to exceed the file size by the one we initially set up as a requirement. The file size of the pictures that were used to display the map it was causing us some problems. We eventually managed to get the jar-file size below 500 kB by reducing the number of colours used in the pictures, and also optimizing the pictures using the *pngout* software.

Design decisions for the graphical user interface and soft keys

The high-level user input in J2ME is the responsibility of the MIDP implementation. Due to the limited input possibilities of a small handheld device all high-level user input is added as commands. These commands are then placed appropriately by the device manufacturers' implementation of java. This solution has both advantages and disadvantages. The approach is necessary to guarantee that applications remain as portable as possible between different devices. On the down side is the fact that developers has less control over the user interface. Using the low-level graphics library it is possible to implement an interface designed to look the same on all devices, but this is outside the scope of this project and there is no guarantee that the interface will work as intended on all devices (Li & Knudsen, 2005).

Soft key assignment is one of the most prominent interface problems discovered during our project. Different hardware devices assign commands to different soft keys. They sometimes place them in a menu and sometimes not. We found it too time consuming to develop specific versions for different hardware, therefore our implementation is not perfect regarding the design of user input, but it is, we believe as close as we could get producing a single portable version. To further clarify the problems surrounding interface design and implementation using J2ME we will use a few examples from our own design process.

The actions most important for the user should be the actions that require the least amount of work to perform (Gong & Tarasewich, 2004). Since most phones have only two soft keys we eventually faced the problem of which action that was the most important for the user when zoomed in, to display information about a point of interest, or to be able to zoom out effortlessly? Only one of the commands could be displayed as a soft key while the other was placed in a menu located under the other soft key. The solution is somewhat of a compromise. The soft key is assigned to different commands depending on context, see *fig. 8*. When the pointer is over a point of interest the natural thing to want to do, is to display its information, when not the user probably has to zoom out as his / her highest priority.

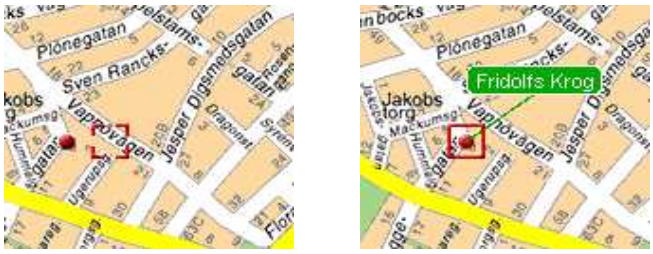

Figure 8. Context aware soft keys: from left to right, zoom out, show information

The map is navigated using a pointer that detects when it is over a point of interest or when near the boundaries of the screen or the map. In order to make the user aware of possible actions the pointer gives contextual feedback and it's described below. We wanted to give positive feedback back to the user e.g. we wanted the user to know that a initiated action would not go unnoticed and we therefore made the pointer change according to different states. Feedback is very important, as the user doesn't know what you, as a designer know, they only know what you tell them (Barfield, 2004; Jones & Marsden, 2006).

Standard pointer.

Pointer when over a POI.

Directional pointers indicating that the map scrolls.

Pointer displayed when reaching the boundaries of the map.

Design discussion and usability testing regarding how to display the name of the object eventually led to the final implementation. We felt that we had two different choices in this design issue, to display it in the top panel or display it near a POI. Since this information couldn't fit in the top panel, and we wanted to show the user that a POI is clickable, we decided to show the info near the POI.

Our initial design involved showing the points of interest as small icons depicturing the type of the object. This design was replaced by showing all objects as a red point by several reasons. The icons would have to be of a bigger size in order for the user to clearly see what it depicts. One icon that is placed in near proximity of another icon would block the other icon out. We also found it difficult, for some of the types, to design an icon that conveys the metaphor to the user with enough clarity.

When listing all the points of interest we also wanted to give the user the opportunity to find the location on the map. This functionality was realized by showing the user in what direction to move in order to find the desired object. We felt that directly jumping to the location possibly would confuse the user and impair the user's sense of orientation.

Standard point of interest.

Point of interest when under the pointer.

Arrows showing direction to the user selected destination POI.

One obvious difference between the overview- and the detailed map is that the overview map doesn't show the POI of the selected type. Instead we chose to give feedback about how many POI that resides under the pointer, see *fig. 9*. This is done by displaying the information as a number and a bar. The pointer also becomes more red when the number of points it is over increases.

Figure 9. Pointer in overview

We felt that the navigation structure for the mobile application needed to be kept as simple as possible. It consists of a simple tree structure where all the screens are accessible through one, or at most two key presses, see *fig. 10*. A menu is often used as a tree structure and in our case the menu consists of no more than seven commands to restrict the human mind with too much information. According to Jones and Marsden (2006) it's easy to use menus because they are recognized easy in memory, but Shneiderman and Plaisant (2005) recommends that the designers should constrain the menu with less than nine commands to not overload the human mind. We have made a conscious effort to place the menu items in order of importance.

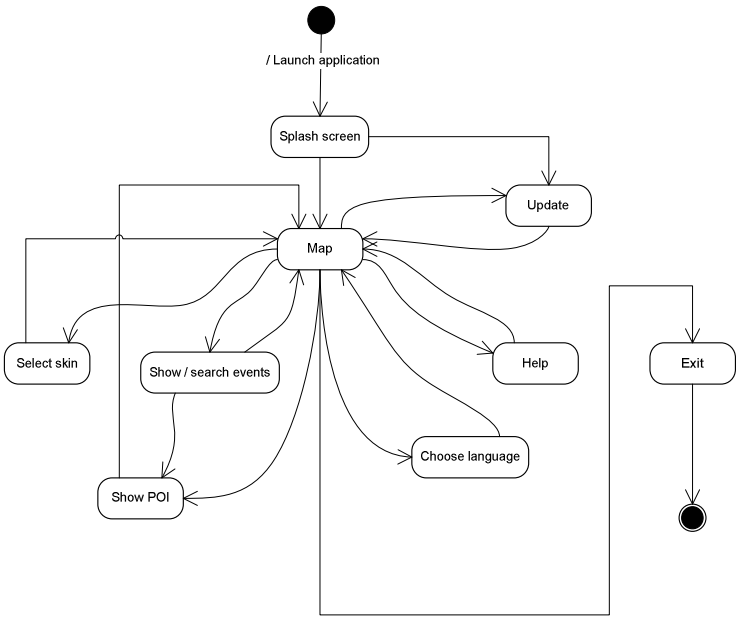

Figure 10. Simplified state diagram of the final design

The current release of J2ME gives limited opportunities regarding the control of witch fonts to use. Every phone has its own font, so we can't really control what font we want to use. We can, however, control the size of the font (small, medium, large). We initially used the medium font throughout the whole interface. However, on small screens the top panel occupied too much of the screen space. We therefore chose to use the smallest font to display the text in the panel. Despite using the smallest font some phones are still not able to display the complete name of the selected skin together with the selected destination. We therefore implemented a function to calculate a suitable length of the text when exceeding half of the screen width, see *fig. 11*. The choice of font colours is a result of an effort to achieve the highest possible contrast between the map, the panels and the text and according to Barfield (2004) the best way to represent text is by having a high contrast between the text and the background.

Figure 11. Font sizes and colours

Initial requirements/design not implemented in the current release

- The current release does not download only the records updated since the last update. This release completely replaces the local database in the mobile device with an updated version downloaded from the database.
- The selection of language is currently not implemented. Perhaps a multi-lingual version is not that useful since all the information about points of interest is in Swedish.
- No landmarks have been implemented in the overview map.
- No context sensitive help screens exists, instead one help screen is used throughout the application.

8.1.2 Administration platform

The purpose of the administration platform is to provide means for clients and administrators to manage shops, by adding new, updating old ones, etc. Basically, the client and administrator pages are separated because of the differences between the authority levels. The two pages, however, are connected by the Login page, see *fig. 12*, which redirects to specific pages according to the logins used (this is something we developed during the elaboration phase).

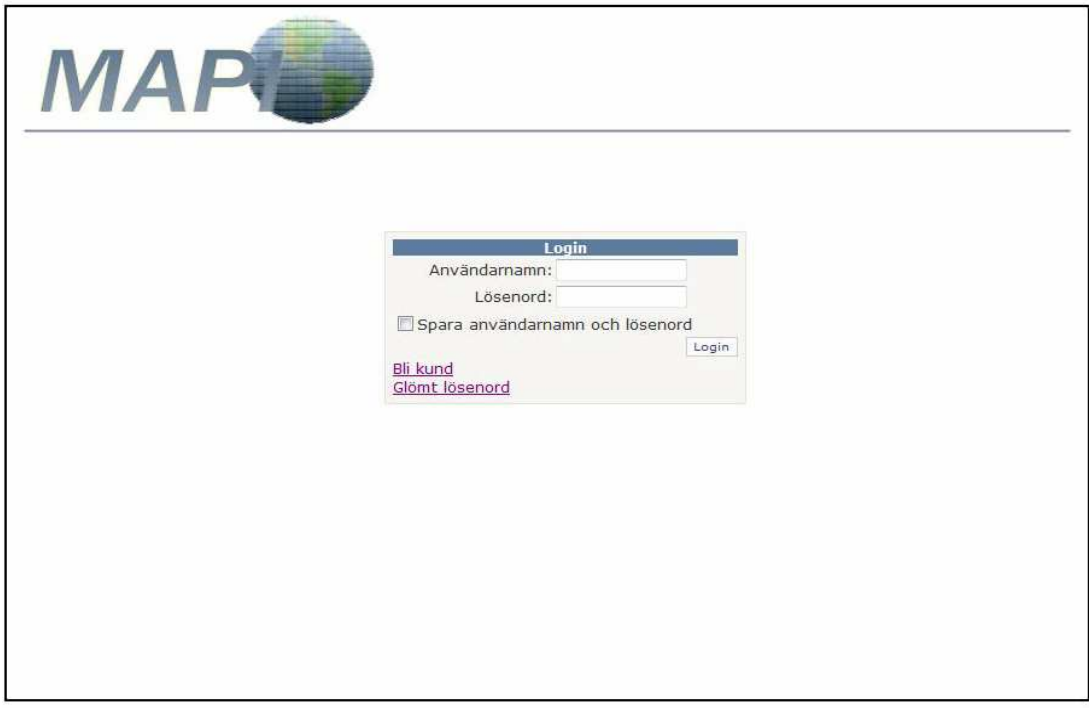

Figure 12. The login page of the administration platform

The Administration platform was created using these technologies: Microsoft Visual Studio 2005, Asp.NET 2.0 and C#. Visual Studio provides visual environment for designing web pages and we used it because we know that Microsoft's tools often provide great support and we were already familiar with another similar Microsoft application, Web Matrix. The application is also one of the few that you could use when you're developing with Asp.NET 2.0. Asp.NET provides a programming model for creating scalable, secure and stable applications and we used C# because we discovered that a lot of tutorials were already available that could help us during our process.

The programming for this platform was almost exclusively made by one of the project members, Joel, the only assistance came when we needed to create a map where the clients could assign where their shop/object was located. We saw the need to allocate new resources halfway through the project but the other group members then would have to learn C# and Asp.NET 2.0 and we made the decision that such a process would require too much of our available resources. Despite this we seem to have implemented almost every function that we strived for. We are still missing some main functions that we didn't find a solution for, some more crucial than others, for example we couldn't restrict the comments to 400 characters. The client can try to register more than 400 characters, but the browser will give an error message when the client tries to do this.

We first focused on developing the system administrator page, and the administration page serves mainly to manage and change client entered info when necessary. We think that it's important if there is an administrator that keeps control of the platform and the problems that could occur and also keeps track of the information. These are the main functions that we implemented in the administration platform:
- Create new clients
- List all clients
- Delete the clients
- Edit clients information
- Comments
- Log out

First, we had to create a function that allowed system administrators to create new users and new shops, because the first time that the clients register their information it won't be registered in the database without the administrators submitting the data into the database, *see fig. 13*.

Figure 13. Administration page to create a new user

The development of the client page was similar to the development of the administrator's page, and its main purpose is to register a new client, add new shop and update information, see *fig. 14*. After the client is registered a username and password is provided by the administrator. Client logs in to the portal and he can then perform the following functions:
- Add/ delete shops
- Add/ delete comments
- Update information on shops, comments
- Retrieve password if lost
- Change password
- Log out

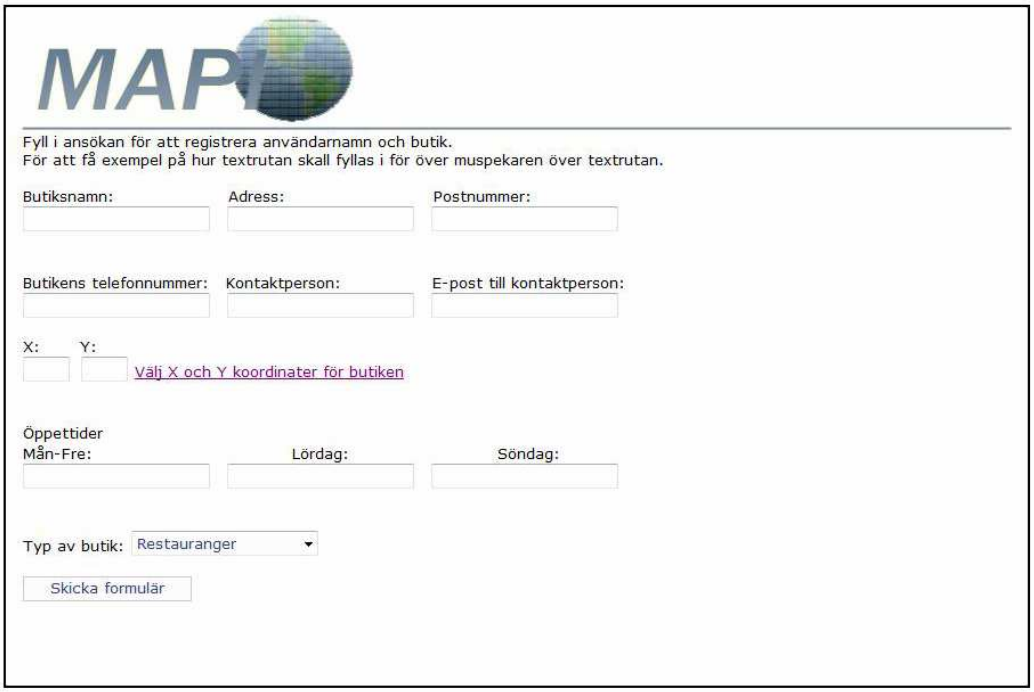

Figure 14. Client page to add a new shop

When a client wants to register a new shop, they will have to open a new window to find the correct coordinates of their shop on a map. We created a java applet for this and had to put it in a new window in order to make it run. The other main function for the client is to add comments for their shops. As we said before, we had some problems to restrict the comments up to 400 characters and the start and stop dates that client has to put in is defined as datetime format in the database, that is if only year-month-day is entered, it will add zeros for hh-mm-ss in the database, see *fig 15* on page 37.

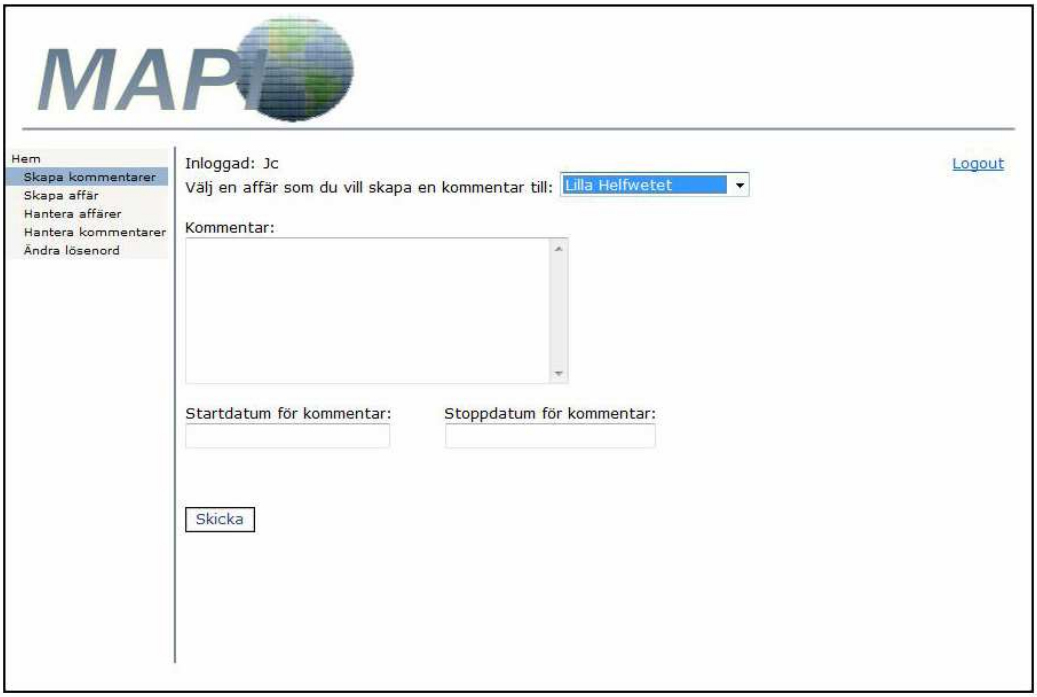

Figure 15. Client page to add comments

Additional functionality that we implemented was to serve the users convenience, retrieve a password when it is lost, changing an existing password, logging out for the sake of security and an option to remember the current username/password for the next login. Due to simplicity, to make the user interface friendlier, when the client fills the data form, each attribute is represented in a separate field. When talking about the functions we didn't implement, we completely discarded the function "registering new temporary event", because in the end, the mobile application didn't take advantage of it.

All functionality on the administrative platform is represented in a tree structure, to ease the navigation and make it easy to use. The main functions are structured and placed on separate pages. Accordingly named links to these pages are located and always present on the left side of each page. Also, to pin point the current location within the tree structure, a bread-crumb trail (i.e. **Hem > Skapa affärer > ...**) is used. In the next paragraph we describe what design decisions were used when creating the administration platform.

Color

Color is an important element of a web page. A poor choice of color may ruin the whole web page design. The text must be in contrast with the background and be well seen. In addition there must be proper link colors, which will guide the user, of what pages is already visited or unvisited [17].

When we created the web page we used white color for background and black color for text. It is one of the most standard choices, as this combination is used as a standard in almost all documents [17]. We also use blue text color for buttons and drop down lists to separate them from ordinary descriptive text. Another issue is the color of links on the page, as it is more important to show that the link is highlighted now than showing what then link was when it was visited. We thought that the best way to do that is to mark it in blue highlight color, rather than changing the colors.

Text
There are several font styles used for text: bold, italic, underline and blink. Also, it is important to have appropriate text font and font size. Hence the text size is important but the user should be able to specify it with the web browser [17]

There is no blinking text on the pages, as it might be disturbing and may sometimes be really irritating. When we created text we also thought that it was enough to use bold and underline text. Underline text is used to indicate that it is a link (at least in standard form) for e.g. "logout". We use bold text as a standard for marking the heading of the paragraphs.

Nielsen (2000) recognizes that a medium text size (10-12pt size) is the most common and best size to use on a web page and we used size 0.8 em. Converting 0.8 em to pt makes it approximately 10 pt [18]. If, however, it is too small or too large, a user can change its size via the web browser. Font Sans Serif is most suitable for information use rather than when you want to tell large stories [19]. We use Verdana (which is also a Sans Serif font) and it's especially effective when used at small sizes. In order to make text more readable and professional looking, it is highly important to use standard text fonts, and not to be influenced by own personal style and experience [19]. Barfield (2004) has also identified that scannable text and links are more powerful to use when presenting information to the user. In our case we're using instructions directly on the links, e.g. 'Skapa användare', that is a direct instruction, saying that this is the page where a new client can be registered.

Style
We try to make it as much comfortable as we can for the user in the following way:

- Grouping text by importance. More important information is higher than less important (Barfield, 2004). For example: 'Hem' is higher up in the menu than 'Skapa användare'.
- Less important information is shown in the bottom-right corner and the more important is shown in the top-left corner (Barfield, 2004; Nielsen, 2000).
  Example: Our logo 'MAPI' is shown to catch user's attention, and indicate what site one is visiting.
- A tree structure is popular and is often used on a web page (Barfield, 2004). A user is used to this structure. For example, we have a main page with sub pages that resides under the main page.

Page Size
The most efficient designs for general Internet audiences tend to use careful layouts of text and links with relatively small graphics. These pages load quickly. Most experts suggest that the graphics used for a page should not exceed 30K for easy loading. Also the developer of the page should pay attention to the length of a page. It must be less than two screens and the information displayed on the page should fit for printing [17].

We decided not to use scrolling at all, as all needed information can be displayed without it. Besides, according to Barfield (2004) it's better if there is no scrolling at all, it's better to have all the navigation links on the same page. However, it was impossible to avoid scrolling in some situations, but we tried to put all the information, buttons and links close to the borders of the box, so that you wouldn't need to scroll to see this information.

As there is not much text on the page it is comfortable to print it. We have also tried to not use large pictures or icons in order to make the page load quickly. We considered icons but bad designed icons could give the opposite effect and, in the end, be confusing for the user (Barfield, 2004). We felt that it indeed could be confusing and chose not to use any icons. In addition, it is really important to mention the following, which is connected to administration portal design issues:

- Quick commands are useful for the impatient expert users (Barfield, 2004; Nielsen, 2000). For example in administrative platform the client can select the option in the check box where it says 'spara lösenord', this means that the client, next time they try to log in, doesn't have to submit their password.
- Feedback is very important. The user often doesn't know what you, as a designer, know, they only know what you tell them (Barfield, 2004; Nielsen, 2000). Hence, e.g. in the administrative platform we tell the clients that the registration is complete and that we will send out a mail soon with their login and password information.
- Positive feedback is as equally important as general feedback (Barfield, 2004; Nielsen, 2000). We give positive feedback by restricting the zip code field up to 5 characters, or by giving an error message when incorrect email is entered (in this case no matching server is found).

8.1.3 User portal

The User Portal comprises of htmls, available from the Internet Browser on a client's computer, and wmls, available via WAP on a client's mobile phone. The User Portal was created with the tool MS FrontPage. This application provides standard means for creating web pages; it's easy and simple to add hyperlinks, insert pictures etc, and the html code is generated automatically, but the designer could also input code if they feel the need for it (like we did for Demo.html). The WAP pages were also created with the help of FrontPage, but the html pages were adopted and simplified (an example is the removed pictures). We then used web2wap converter to convert html pages to wml pages [20].

The coding for this platform started quite late, we had identified the structure in the elaboration phase and didn't feel the need to start code this until the latter stages of the development process. One of the reasons was probably because we felt that this was one of the least important parts of our system. We had to, however, find a solution for developing correctly made WAP pages and also find a java application that could run the JAR file directly on the web page. In this section we will describe the user portal design and what design decisions we made.

The web pages are available in two languages: English and Swedish (latter as default). Contents of the user portal, represented in separate pages, is the following: Demo of the application (the default first screen), download the application (JAR and JAD files), and help on the service. The first screen (the home screen) introduces the reader with the main purpose of the user portal; it provides an example screen of the MAPI application on a mobile phone and a demo, which is opened in a new window, of the same application, see *fig. 16* on page 40. The demo is implemented with a MicroEmulator [21]. We discovered that it wasn't really working properly, because we used the same application as for the mobile phone, which requires some special mobile parameters not available within the emulator (*discovered in final functional test* on page 45).

MAPI
Hem >
Ladda ner applikation
Hjälp
English web page
Det är här Du kan ladda ner den mobila turistguiden MAPI. När Du väl har laddat ner applikationen, kan Du personalisera vad Du vill se för någonting och uppdatera för att få de senaste nyheterna om ett evenemang.
Uppdatera
Välj evenemang
Alla evenemang
Språk
Hjälp
Meny
Zoom
Avsluta
1 km
Pröva på vårt demo för att se hur vår applikation fungerar!
>> Starta Demo <<
Menu
Zoom

Figure 16. The first screen of the user portal with the demo emulator

The main purpose of the user portal is to be able to download the application. Our second screen includes a page where the user can download the application and we also included an instruction text with short instructions of how to download it to the mobile phone, see *fig 17*.

MAPI
Hem > Ladda ner applikation
Ladda ner applikation
Hjälp
English web page
Ladda ner applikation
För att ladda ner applikationen:
1) Tryck på "Ladda ner JAR" och "Ladda ner JAD" (några telefoner behöver båda filerna installerade)
2) När nedladdningen är klar, för över filerna till mobiltelefonen med hjälp av Bluetooth, IR etc.
3) Öppna applikationen på din mobiltelefon genom att öppna programmet 'MAPI'
Ladda ner JAR
Ladda ner JAD

Figure 17. The download application screen

There is also a Help page, providing brief information on the product itself and the requirements that a mobile phone has to satisfy, for more information see *fig. 18* on page 41. The WAP pages include similar information, only more compact and adjusted for the mobile phones, i.e. pictures were removed and information is more compact. In the following segment we describe some distinct issues of the user portal web page design.

Hem > Hjälp
Om programmet
Ladda ner applikation
Hjälp
English web page
Med MAPI kan man navigera en karta och personalisera vad som ska visas på mobilskärmen,
exempelvis olika typer av affärer, med hjälp av vissa tematiseringar.
Följande grundläggande krav krävs av mobiltelefonen för att kunna exekveras:
Java-telefon (J2ME med MIDP 1.0 och CLDC 1.0)
Färgskärm, minsta upplösning är 128x160 pixlar.
Att mobiltelefonen har minst 3 Mb intern minne och att mobilen har 1 Mb fritt minne.
GPRS
Wap 2.0

Figure 18. The help screen and the requirements of the mobile phone

Common design issues for user and administration platforms

Considering the design, to make it as user friendly and understandable as possible, here are some distinct issues in the design. In the user portal we use the same color, text, etc. as on the administration platform. We want the design to belong to the same product so we didn't want to confuse the user by different logos or web page colors.

So the following elements are the same for both administration platform and user portal:

- White color for background and black for text
- The same logo
- Bold text we use as a standard for separating a heading from a paragraph
- Font Sans Serif
- Scannable text. E.g. link for downloading the applications says 'download application'; it should be direct instructions speaking for itself.
- Grouping text by importance. For example: 'Download' is higher up in the menu than 'Help', see *fig. 19.*

Hem > Hjälp
Om programmet
Ladda ner applikation
Hjälp
English web page
Med MAPI kan man navigera en karta o
som ska visas på mobilskärmen,
exempelvis olika typer av affärer, med hjä
tematiseringar.
Följande grundläggande krav krävs av n
kunna exekveras:
Java-telefon (J2ME med MIDP 1.0 o
Färgskärm, minsta upplösning är 128
Att mobiltelefonen har minst 3 Mb ir
mobilen har 1 Mb fritt minne.
GPRS
Wap 2.0

Figure 19. The logo in the top-left corner and the menu with text grouping

Those are the elements, which indicate that those two portals (user and administrator) belong to the same product. Talking about the decisions on design properties, why those properties and no other was chosen to use, can be found under administration platform design decision documentation.

Due to the different tools used for the creation among the two web portals, we have some differences. The text size is 10 pt; it is approximately 0.8 em [18]. So this parameter is quite the same as in user portal. Some other differences between those two portals are, for example, that link behavior is different from the one in Administration platform. In this case it is more important to show that a link was visited. So we are using two different link colors: for visited and unvisited links. In the web page the default color for each link parameter is used, dark blue for unvisited and purple for a visited link [17], see *fig. 20.* We wanted to keep standard link colors so that the user wouldn't need extra time and effort to understand new color combinations which the user are not used to.

Figure 20. Showing the color for visited and unvisited links

8.2 Final testing and validation

We tried to iterate as much as possible with testing and validation, this was one of our objectives with the mobile platform. The other two platforms, the user portal and the administration platform, were unfortunately not as involved in this iterative process as the mobile platform. We felt that it was enough if we tested these platforms at the end of the project and one of the reasons was probably because of the extra time constraints it would cause us. We think that an iterative approach to test and validation of these platforms is also useful but we didn't have enough resources to make a thorough test before the end of the project.

8.2.1 Mobile platform

This was the only platform that we tested with an iterative approach and it was also the only platform that we did a user acceptance test on. We did the acceptance test instead of a more advanced system and software related test, like black- and white box testing (Sommerville, 2001). An acceptance test is also a type of software test but in our case we also used it to verify the acceptance of the end-user than to just test the functional requirements. We created form based test scripts where the software developer need to decide what modules to test, we made five modules, and what steps every module should be tested on [22]. This form based script was created with the functional requirements in mind and we also wanted to get acceptance on the application from the end-users. With the five modules we also made some tasks and instructions that the testers should complete before moving to the steps that every module has.

- Module 1: Update the application
  - The user should connect to the database and update the application.

- Module 2: Choose event
  - The user should choose a skin, in this case ‘Restaurants’.
- Module 3: Navigate the map
  - The user should navigate to “Galgberget” where they need to find the fictive restaurant “La finitia” that’s located at the street “Carlavägen”.
- Module 4: Information about the object
  - The user should find information about the object, the restaurant “La finitia”, and find information about the menu for week 2.
- Module 5: Exit the application
  - The user should exit the application

Every module has seven steps that the tester should try to answer before moving on to the next module. The seven steps (we can also call it questions) is a combination of usability steps and functionality steps. If they think that a step have been fulfilled they mark it in the table and set the date and their initials. If they feel that one of the steps in a module is incorrect they write a failure report for that step e.g. they write what the problem is with this step in that specific module. When we are finished with the test on different platforms, in our case we use two different mobile phones, we ask the tester some basic questions about the application, for example, how they think it works in general and what they like and don’t like about the idea. *Appendix L: The acceptance test* shows what steps we made for each module and also what final questions we asked the testers. The test was performed in our project rooms, but we would have wanted to do the test in an outdoor environment if we had both the resources and time to test it in a more realistic context. The testers were from Halmstad and we didn’t use any tourists during our test.

We got quite similar answers from the testers, both on the modules and on the final questions. Overall, the users seem to be happy with the mobile application and thought that it was pretty easy to use and they also saw potential in the application. They thought that it was a bit unfortunate that it looked so different on different mobile phones and that it was missing a GPS (global positioning system) function. Everyone thought that a GPS function would have made our application even better. They also thought that it would be nice if the application had a search function (so you could search for a specific area or street). Other than that we got both positive and negative feedback about the design and the functions, although there was mostly positive feedback.

Between our test phones, a Nokia 6111 and a Sony Ericsson K750i, the feedback was about the design and why it looked so different on different phones. The Nokia phone has a small screen so it means that you can’t see as much of the map as you can with the Sony Ericsson mobile, because it has a bigger screen and can display the map in a higher resolution. The users, if they were to use the application, recommends the Sony Ericsson mobile as the default phone.

Sony Ericsson was more useful because it showed a larger part of the map and this meant that you didn’t have to scroll as much. Someone recommended that this could have been partially solved if we could implement another overview screen so that you didn’t have to scroll that much. We didn’t have time to implement this function and we thought about it before, but we decided that it could be cumbersome for the user to have to press two times to get to the detailed map. We also got response on the differences between the alignments of the buttons depending on the mobile phone. This is something that we can’t really change; we would have to do two versions (one Nokia version and one Sony Ericsson version).

Other design issue's that was brought up during our test, that wasn't tied to a specific phone, was how illogical some of the menu text was. The testers weren't sure of, for example, what the 'show' command in the menu meant. One of the users thought that it would take you back to the map (it worked like this when he used the function before). The 'show' command was supposed to show info about an object, but it only worked when the pointer was over the object. The user discovered this by mistake and he thought that it didn't make much sense. We did have a chance to change it and the 'show' command is now visible only when the user is over an object and this means that the user can't zoom out when they are over an object.
One other thing that we had time to change was the 'help' screen, because the users that used it thought that the information was quite basic and it could instead have a fully working tutorial of an assignment.

The testers seemed to think that the functions worked correctly and that it shouldn't be a problem to use the menu after a while, or as one user puts it; "every user that has some experience with their own phone's menu system should be able to use it". Our application crashed one time when the user was navigating the map with the pointer. We recognized this problem, which was trigged when the user pressed two buttons at the same time just before they were to scroll the map, and we are confident that we have fixed it. We are, though, aware that the application still can freeze sometimes and this seems to be limited to what phones the application is using. The test showed that our functions worked, even if we have some design issues and it's a little instable sometimes, and the testers would absolutely consider using our application. One of the users said that this application would be more useful for a tourist, when finding a specific restaurant, than "asking a citizen that lives in the city".

8.2.2 Administration platform

The administration platform has a lot of requirements so we thought that a functionality test, a so called black box test, was enough in order to expose defects in the system. According to Sommerville (2001) a black box test is a test where one tests the inputs of the system and its related outputs, the tester is only interested in the functionality of the system and not the implementation of the system. What this means in practice is that we present certain inputs, both correct and incorrect, that we test with this system. If an output is not the one predicted the test has successfully found a problem with the software and system.

We had time to make two functionality tests (the same inputs were used both times). This meant that in the end we could minimize our problems and implement many of the main functions that we wanted to implement. These were the functions that didn't work correctly when we tested the second time (note: some of these have been checked as 'YES', but we found a new condition that made it a failure, in these cases we have given a description of the problem):

Clients

- *1.3 Login the client*: You can register, but if you input the wrong password five consecutive times the account will be closed. The user doesn't know this, because we have no message that alerts the user.
- *1.4 Register comments:*
  - *Register comments:* No restriction on 400 characters.
- *2.1 Registering new temporary event:* This function isn't implemented.

Administrators

- *1.1 Login the admin:* You can register, but if you input the wrong password five consecutive times the account will be closed. The user doesn't know this, because we have no message that alerts the user.
- *1.4 Delete the clients:*
  - *Delete the clients:* Can only delete the client, not the shops that the client has.
- *2.1 Search for the shop:* This function isn't implemented.
- *2.2 Edit clients information:* You can't edit the name of the client.

8.2.3 User portal

The user portal is, if you look at the requirements, our smallest platform. The test that we did on this platform was therefore quite simple. We did a functionality test even though it wasn't as sophisticated as the functionality test for the administration platform. Our inputs were categorized according to the two different platforms that we could run the user portal on; the WAP pages on the mobile phone and the HTML pages in the web browser.

WAP

These were the inputs that we tested with the WAP pages:

- Accessing and loading the WAP page
- All pages are accessible
- Downloading the application correctly

There were no successful findings with the first input, we could access and load the WAP page correctly with every phone we tested (the address to the main page is www.utgren.com/wml/index.wml). This means that the first screen and its functionality worked correctly but we didn't test usability issues like why the text font was different on different mobile phones. We found the same results with the second input, there weren't any successful findings with this one, and it worked correctly with the phones we tested on. We did, however, find some problems with the last input.

We could download the JAR file correctly to our mobile phone, even though we couldn't specify the folder, but when we wanted to download the JAD file, the file that we believe that some phones need to have, it opened a text file or gave us an error message. This means that we have successfully found a problem with the software. We started to analyze the problem and tried to fix this, but the test phones can't seem to find the file.

It seems like the mobile phones that we tested on can still download and execute the JAR file and application without installing the JAD file. We believe that the JAD file is not necessary for phones that are less than three years old, something that we should have discovered in our early feasibility test. Other than this fault, and the cosmetic faults, we didn't find any more functionality problems with the WAP platform.

HTML

These were the inputs that we tested with the HTML pages:

- All pages are accessible and loads correctly
- Downloading the application correctly
- Demo is loading and working correctly

With the first two inputs we didn’t find any new problems. The only accessible problem we found was that it can’t seem to find the JAD file, even though it’s clearly on our server. We had some serious problem with the demo and it wasn’t stable at all. If we discard the problem with the small screen and instead concentrate on the functionality it was clear that the demo didn’t work correctly. It became more and more instable the more you used the demo and we couldn’t use all the functions. Our goal with the demo was to show the user what you could do with the mobile platform so it was rather important that it worked correctly. Unfortunately we couldn’t fix it before the end of the project, but we still have it on the page to show how we wanted it to function. We also tested the html pages on two different browsers. All links were accessible on both Mozilla Firefox and Internet Explorer. The design may have been a little bit different in Firefox, but the functionality was the same.

9. Discussion

We have come to an end and it always feels like you have gone through a life time when the project, finally, reaches its final stage. We have worked very hard and very intensive to produce a system that we can feel proud of and feel that we have accomplished something. Sure, our J2ME application has some bugs and our administration platform is perhaps missing some functionality and the user portal doesn't have a correct working demo, but this doesn't really matter at the end. We have worked together as a group to try to create something from the scratch and our development time was only a little more than 3 months. If that's not at least a mildly success, then what is? From the beginning we were nine people that were going to carry this project on its shoulders, but as the first weeks went by we lost three project members. This was of course a set back and it meant that we had to reorganize the roles and the responsibilities a bit. This made that we, the six people that were left, had to work harder than ever before to produce something until the due date. During this process we have tried to follow our system development methodology, not strictly but in some way at least, and make sure that the communication works between the group members.

In the next heading we will describe how this social interaction worked between the group members and what negative aspects and positive aspects we found during our development. Every group member will give its point of view about the project and what they feel about the process and what they have learned. Our use of the system development methodology will finish our discussion about the MAPI project.

9.1 Group interaction and work

The project consists of, as stated before, six people. These six people have different knowledge and background, both socially and educationally. We have two computer engineer students from Lithuania, one Swedish computer engineer student and three informatics students (also from Sweden). Because we have two people from Lithuania we had to use English for all our design meetings, discussions and work that required cooperation between these two persons and the other members of the group. This was certainly a new experience for all of us, but we had to handle the situation and the language barrier wasn't really a problem. In the next section we will describe what the different members of the project learned and what experiences they gathered from this project.

I feel that the position that I have, as the project leader, has given me certain rights and responsibilities. In the beginning I was excited about the project and the role that I chose. I was looking forward to leading the project and watch it slowly grow as it became a fully working system. This enthusiasm didn't last during the later stages of the project but I have still learned a lot about project management and how to better discuss and plan a project. I think that I/we should have looked into the different assignments and roles a little bit more to make it more even. It's also a shame that we didn't have at least two more people that could help us with the project. I am confident that this would have helped us during the development and we would have had more time for tests and implementation.

When we first started, we didn't really know where it would lead us. We had it clear that the maps should be a central part of the application, the core of what everything else would be spinning around. Under the process we discovered that not all the features we wanted could be implemented before the project deadline and there were some "wild" discussions about which way the project should take. Before this project I had never really done any J2ME-programming at all. Because of this, it took some time to actually get the programming float in the right way. It was not before the last weeks of the project, that I and Mats really had the skills needed to solve all the problems and bugs discovered in order to get a fully-functional prototype running. I have learned much about the J2ME-style of programming with all its possibilities and also limitations when it comes to realize an application like ours, intended for interaction on small mobile-phone screens. I think that the application we have up running today is quite useful and user-friendly, even if it lacks some functionality like search on street-names and places. And of course GPS-functionality would be a nice feature to have. At a whole I feel that the project was a success and the final product has all the possibilities to be evolved further, with the adding of new features and so on.

I think the MAPI project was successful, even though we did not manage to implement all functionality that we were thinking about, but the main functions are working correctly and without any problems. In addition some functionality was better developed during the project than was planned in the beginning. When we worked with the project we faced a lot of problems. The main one was that mobile phones do not have the same standards. So we were forced to test the application on as many mobiles phones as possible and we often found out that in different mobiles it worked differently. In order to solve this we had to change the way we implemented some of functions. The next problem was, that we were lacking competencies in some fields such as programming of mobile application or database programming so it took some time to gain this, but we finally managed to not only do our work, but also to learn new things. In the end the project helped us to learn how to work as a team and how we should distribute our work, because we had in the beginning o f the project also this problem.

The project was finished although not all functionality was covered fully, perhaps due to lack of time. I felt that we had some good coordination and a good pool of resources. I probably could not say anything bad about the management, and this is the essential good part of the project: it was fully organized, important thing was weekly diaries, good communication, good coordination of changes, documenting what is still need to be done, etc. It also felt like we had a good project leader and a good atmosphere inside the team. What could perhaps have been different: resources might have been allocated more even (on programming, namely) and milestones for the functional part might have been more strict and defined, this might have helped to push application implementation, and leave some more time for testing, implementing additional functionality and receiving user feedback and documenting it, fixing what is wrong, etc. This also ended in uneven time allocation, as most of the functionality was implemented at the end of the period, leaving space for uncertainty. But we have a working product and good experience that will for sure be useful for coming projects!

9.2 System development

The system development has definitely been iterative, but not as structured as we perhaps hoped for. We decided, after much consideration, to use OUP as our methodology and it helped us in our process, but we modified the methodology so that it corresponded to our own agenda. These were some of the principles that we didn't use:

- We didn't produce milestones that would mark the end of a phase.
- We didn't create any template patterns that would show our specific iterations.

When we evaluated how we used the methodology it was also clear that we used the principles of RUP as much as we used the principles of OUP. This means that our development process was more a combination of those two than just using one of them.

The milestones that we did create weren't as realistic as we first thought and every milestone we created seems to have been delayed somehow (evidently showed in our time schedule).
This meant that we, in the end of the project, had to work harder than ever before to create a fully working system. Both RUP and OUP are set up so that the developers shouldn't have to produce all the coding and implementation at the end of the project. We tried to avoid this scenario as much as possible and even though we made iterations we felt that almost every function was implemented at the end of the project. One of the things we can blame on is the resources, but we should also have made more realistic milestones when the first ones were delayed. We did, however, try to use one of RUP's trademarks, UML. This helped us when we needed to communicate with each other. The first phase and the second phase, the elaboration and the inception phase, were moderately structured and we seemed to follow our roles and artefacts. The problems came with the construction phase, or to put it simple, when we thought that we were finished with the elaboration phase. It seems like we thought that we were finished with this phase and we continued with programming our system instead. We should perhaps have deleted some of the functions that we implemented, but we were determined to produce a fully-working system before the deadline.

If we discard the problems, we feel that the process did work and we're not sure if we could have made a better project with another equally iterative process. We now have a basic understanding of how the process works and if we were to use it in the future we would know how to use it in a more efficient way.

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Appendix A: Stakeholders

A stakeholder analysis is performed in several stages:

- Identification of stakeholders.

  In principle, a large number of individuals and/or organizational units can be stakeholders. In practice, the number must, however, be limited to the relevant stakeholders; i.e. to those who are influenced by the identified problems and for whom the project's lifecycle and success are decisive.
- Prioritize the stakeholders.
- Start with requirements and contributions.
- Describe the success criteria for requirements and contributions.
- Find the stakeholders' focal areas in terms of risks, finances, time and quality.
- Prepare a communication strategy based on the stakeholders' wants and needs.
- Identify the stakeholders' positions and roles.
- Make the success criteria measurable in order to make realization of the requirements easier.
- Identify influence on/ influenced by the project's result and process.

Possible stakeholders
Stakeholder:
Description (where necessary):
Targeted end user:
Current marketing channels:
Added value for stakeholder:
Critical Success factor:
Added value for end user:
Issues:

Stakeholder 1: Halmstad City
Description: http://www.halmstadcity.se. Halmstad city is an interest group focused on strengthening Halmstad's position as a cultural and commercial centre. The organization provides a member card ("Citykortet") giving customers a discount at certain stores in Halmstad. Maybe they could be a partner when introducing, or showing new info on, stores to customers through our service. If we continue to talk about Halmstad city and their stores, which we will be our 'start up' town, they try hard to always evolve and get exposed to consumers and media. They want to win the prize 'The city centre of the year; 2007'. This would of course be a boost for the celebration when Halmstad turns 700 years (if they win it). It seems that the city, store organizations, and the land lords are all involved in this. The interesting part for us is that the contest is measured in, at least one of the measurements, how many visitors there are and how satisfied they are.

Targeted end user: Tourists and local residents.

Current marketing channels: http://www.halmstadcity.se, http://www.2007.halmstad.se, www.solheimcup.golf.se, www.halmstad.se.

Added value for stakeholder: Opportunity to market themselves with a high-tech profile.

Appendix A: Stakeholders

Critical Success factors: That there's a loyal customer base from the start. The stores would probably want a large number of customers already using this product, before they decide to market the product to the customers.

Added value for end user: The user will see where the latest offers are and where they could get a discount, the member vs. store relationship could improve by this.
Issues: It takes time before they can earn revenue on this. It will take some considerable time before a big loyal customer base is created.

Stakeholder 2: Tourist information office
Targeted end user: Mainly tourists, maybe people new in town, bohemians and vagabonds, people exploring Europe by car or train.

Current marketing channels: An obvious place to visit as a tourist, public advertising, web page, pamphlets and flyers, newspaper advertisement, commercials, word of mouth.

Added value for stakeholder: Just in time marketing, administration of daily schedule of events, market events and locations to the user based on interest, the possibility to make quick changes based on weather, cancellations, etc., possibly support for information on public transportation, where to find a place to sleep and where to eat, market the city with a high-tech profile, make the end user aware of happenings not within their current location, to display landmarks of interest like museums, objects of historical importance and other interesting sightseeing locations.

Added value for end user: More information than a map could give, dynamically updated information, compiles needed information into a single place (no need for the end user to compare offers and locations), possibly reminders of interesting events based on personal interest.

Critical Success factors: That the tourist offices tell the tourists that this option exist, after all it's an option (complement) to the ordinary map.

Issues: The technology shouldn't have any major faults; it should be as ubiquitous as possible. If it's difficult to use, the users/tourists will probably just use the maps.

Stakeholder 3: Restaurants
Targeted end user: Everyone hungry, tourists, locals looking for an offer or having a hard time making a decision.

Current marketing channels: Public displays, pamphlets and flyers, newspaper advertising, commercials, word of mouth.

Added value for stakeholder: Just in time marketing (lunch time offer, competitive price, specials, events e.g. live music performance), adaptation for disabled, possibility to reach end users not within their proximity, opening hours.

Added value for end user: compare prices; compare menus and getting the location of a restaurant.

Appendix A: Stakeholders

Critical Success factors: All the stakeholders identified, so far, depend on the latest updated information. The restaurants are more dependent on this than any other stakeholder. If the lunch menu isn't updated with the latest information the product will loose its advantage.

Issues: The issue is connected with the critical success factor. The restaurants have to have the latest information available and they have to be active updaters. This will require both resources and manpower.

Stakeholder 4: Local shops
Targeted end user: Tourists and locals with an interest in shopping or a lot of money.

Current marketing channels: Public displays, television commercials, pamphlets and flyers, radio commercials, word of mouth.

Added value for stakeholder: Just in time marketing (special offers, campaigns), hi-tech branding, advantageous pricing (price comparisons), marketing based on user preferences, and targeting customers not currently in their proximity.

Added value for end user: Price comparison opportunity, overview of what brands the store provides, opening hours.

Critical Success factors: This stakeholder can be compared with Halmstad City (they have at least a connection). They will not bother to do updates if they see that the product don't attract any customers.

Issues: Do they want to update often? They want to attract to new customers but how many "special offers" can they afford to advertise.

Stakeholder 5: Hotels / hostels
Targeted end user: Tourists, backpackers, business people attending meetings, bohemians and vagabonds.

Current marketing channels: Public displays, travel agencies, corporate commitments, television commercials, word of mouth.

Added value for stakeholder: A high-tech profile catches customers who are indecisive or not god at planning, competitive pricing (price comparison), make their location known and market their unique features (pool, gym, breakfast).

Added value for end user: A quick decision on where to sleep, price comparison, information on the location and a way finding service.

Critical Success factors: That they show what they got, show how their hotel is special and how it can offer a unique service.

Issues: The issues that can occur with this stakeholder are no different from the others. They probably don't have to update as often as, say, restaurants but they still have to show what they want to advertise.

Appendix A: Stakeholders

Stakeholder 6: Cinema / theatre
Targeted end user: People interested in the cinema or the theatre.

Current marketing channels: Television commercials, movie commercials, newspaper ads, tourist information office, web page, word of mouth.

Added value for stakeholder: Just in time marketing, a bigger exposure of their schedule, ability to attract customers not planning to attend.

Added value for end user: Opportunity to not make plans (make a decision on the fly), information about events that they want to attend if they knew they were happening now, simple information searching (what, when and where).

Critical Success factors: That the information displayed is consistent and that the information is enough for the customer

Issues: The cinemas may want to use video clips and images to show information about the movies. This is not something our application will do, at least not in the first version of our application.

Stakeholder 7: Public transportation
Targeted end user: Tourists and travellers as well as residents of Halmstad.

Current marketing channels: Public displays (signs, screens at train stations, bus stops), television commercials, pamphlets, web page.

Added value for stakeholder: Just in time information, high-tech branding and if information is perceived as reliable, more paying travellers.

Added value for end user: Last minute decisions, supports planning of travelling, easy accessible information about services not in your current proximity.

Critical Success factors: That the bus signs have the right kind of information and that the different symbols stand out in a crowded map.

Issues: If there is one stakeholder that needs GPS it's this one. GPS could be necessary if the travellers are using a bus and needs to see where the next stop is located and where they are according to the map

General added value for stakeholders
A few general values adding features have been identified that applies to most of the stakeholders:

- Just in time marketing (provided that the update functionally works painlessly).
- Remote marketing (the opportunity to attract mobile customers not in the stakeholder's proximity).
- Comparative marketing (an opportunity to outdo your competitors regarding pricing and unique offers.
- Information service (a dynamic way to display information to potential clients).

- Location awareness (let the potential clients know the geographical location of your business)
- High-tech profile (could be beneficial for companies that needs a high-tech profile e.g. internet cafes, gaming halls, universities).

General added value for end users

The end users can be tourists or people that live in Halmstad. The differences between these two groups could be, for an example, how they use the information on the maps, but this service should apply to both these market segments.

- Just in time information (The end user will get the latest update, but it has to be quick and functional).
- The map will always be with you (probably more often than an ordinary map).
- More information available to the user and more customized according to their own opinions.

Appendix A: Competitors

There already exist mobile maps and maps on the Internet that you could use, for example Google Maps, Yahoo Maps etc. These are competitors to us, but not our biggest competitors. We feel like it's more interesting to first look at the services that we're mainly competing with.

Ordinary Map:

Pros

- It's free to use (if it's just the map)
- Usually you will get the whole area of a town/place to look at.
- It's not that hard to get a map.
- The most important and basic symbols are often displayed.

Cons

- It's not possible to update the map without getting a new one.

Event-information sites (like Halmstad.se)

Pros

- Search for all the latest information about events and what is happening.
- Many people are used to search for information on the Internet before they do something.

Cons

- Not always accessible to the user; at least when the user is on the move.
- The planning is more extensive when using the Internet to find information.

Yellow pages sites (Hitta.se, Eniro.se)

Pros

- Easy to get information about the whereabouts of different shops and stores.
- It's possible to get a road description for different locations

Cons

- Not always accessible to the user; at least when the user is on the move.

Electronically maps

-Google map:

- Available in Europe countries: France, Italy, Germany and Spain.
- Additional functions: Local business locations and contact information appear all in one place, integrated on your map.
- Technology used: Ajax (Javascript and XML); map is stored in internet;
- Technical specification: supports Java-enabled phones, PC on Internet
- Free web map server application

-Yahoo map:

- Available countries: United States and Canada
- Additional functions: street maps and driving directions; Point of Interest Finder - used to find businesses and other points of interest
- Technology used: Ajax, Flash; map is stored in internet
- Technical specification: PC on Internet
- free online mapping portal

Appendix A: Competitors

-MapQuest mobile:

- Available in Europe countries: Belgium, Denmark, France, Germany, Italy, Luxembourg, Spain, Sweeden, Switzerland, United Kingdom, Netherlands.
- Additional functions: Instantly find your way with interactive color maps, step-by-step instructions, reverse directions and recall of recent addresses. send map and directions to your phone from the MapQuest.com website
- Technology used: Mobile Optimized Navigation Data, ("MOND")
- Technical specification: supports GPS enabled phones
- Monthly subscription plan to MapQuest Mobile $3.99

-MapQuest navigator:

- Available in Europe countries: Belgium, Denmark, France, Germany, Italy, Luxembourg, Spain, Sweeden, Switzerland, United Kingdom, Netherlands.
- Additional functions: Find restaurants, hotels, or theatres from the MapQuest.com database, Locate addresses, intersections, or zip codes with ea, Customize routes by finding the fastest or shortest route, or avoid toll roads and highways, send map and directions to your phone from the MapQuest.com website
- Technology used: Mobile Optimized Navigation Data, ("MOND")
- Technical specification: supports GPS enabled phones, Web-enabled mobile phones and PDA.
- Monthly subscription plan to MapQuest Mobile $9.99

-ABmaps:

- Available in Europe countries: Austria, Belarus, Belgium, Denmark, Finland, France, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom
- Additional functions: address finding, route planner, Weather forecast, Traffic information in real-time
- Technology used: streaming vector graphics and Macromedia Flash; maps data doesn't have to be stored on the device itself but downloaded from the Internet using GPRS
- Technical specification: supports Java-enabled phones
- Free Web Map Server and portal

– Map 24

- Available in Europe countries: Andorra, Austria, Belgium, Denmark, Finland, France, Germany, Great Britain, Northern Ireland, Hungary, Iceland, Ireland, Italy, Liechtenstein, Luxembourg, Monaco, The Netherlands, Norway, Poland, Portugal, San Marino, Slovakia, Spain, Sweden, Switzerland, Turkey
- Additional functions: providing street level maps and driving directions, address and point-of-interest, interactive map
- Technology used: AJAX API combined with the Map24 core technology
- Technical specification: computer must have an up-to-date version of JavaVM
- a free online mapping service

Appendix A: Competitors

-Windows Live Local:

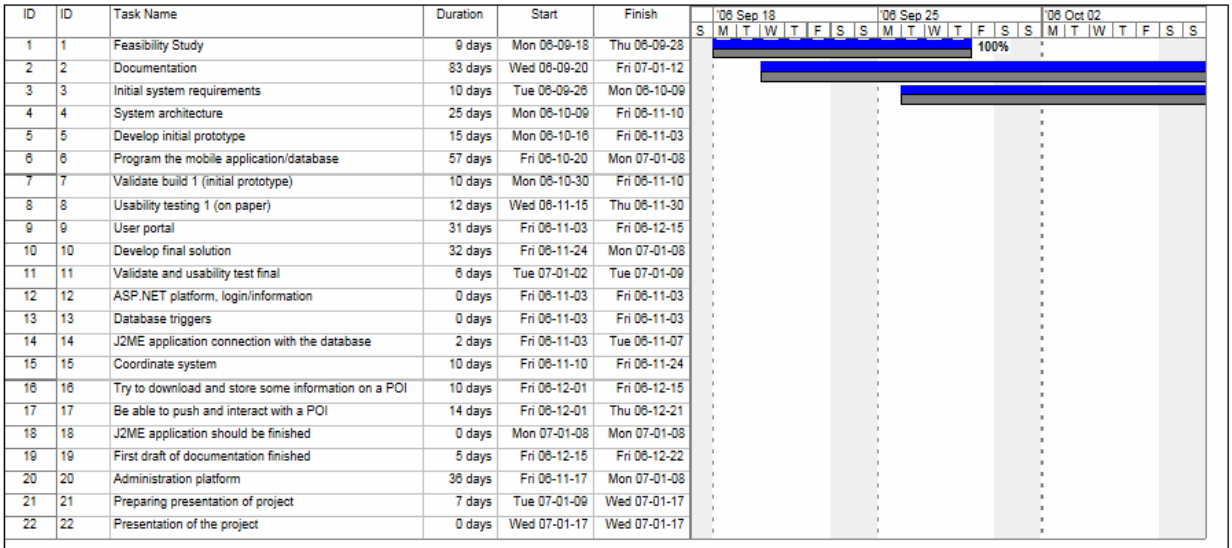
- Available countries: US, UK
- Additional functions: street maps, satellite imagery, driving directions, and traffic information, Yellow Pages; online local search
- Technology used: MapPoint technology
- Technical specification: PC

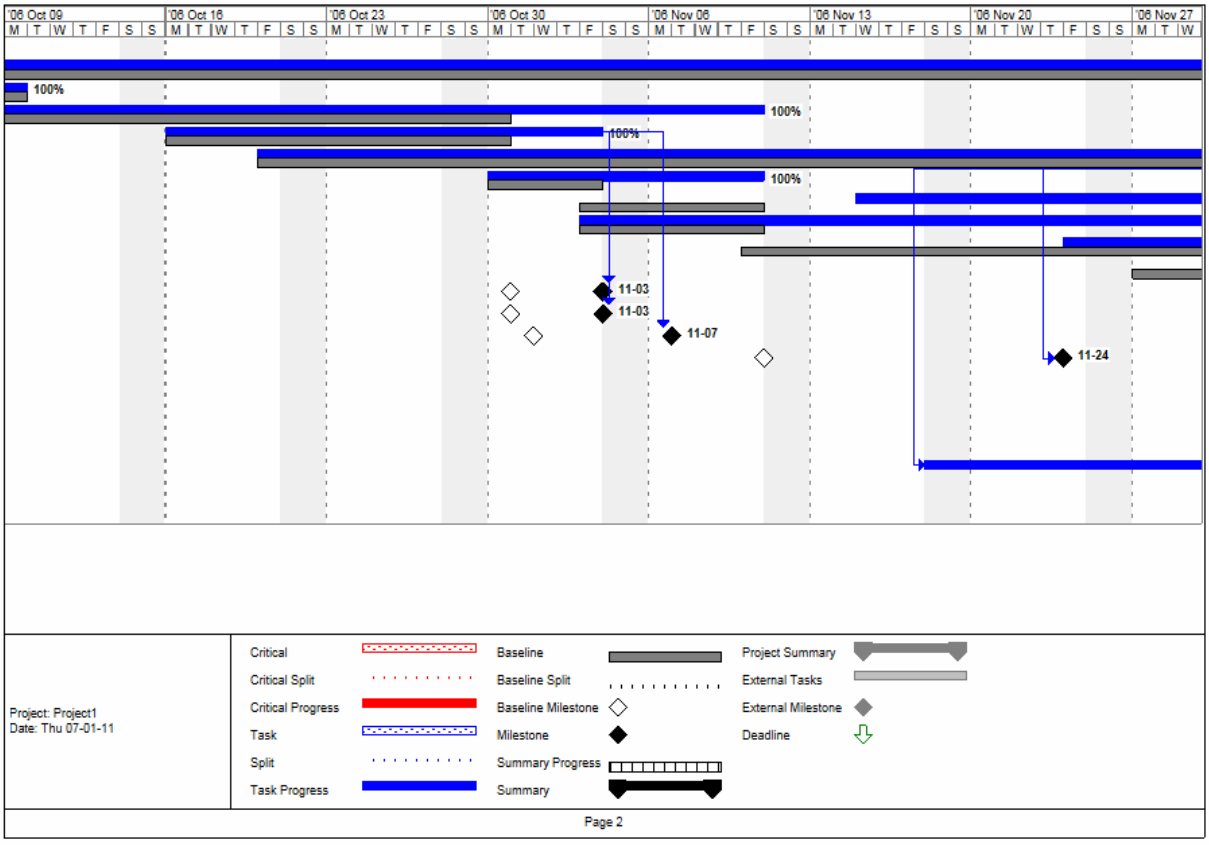
-Wayfinder Earth

- Available countries: Canada and the USA, Andorra, Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lichtenstein, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.
- Additional functions: street maps, address and point-of-interest, interactive map, online local search
- Technology used: Ajax and Javascript
- Technical specification: supports Java-enabled phones
- A free online map service; only fee is the connection fee.

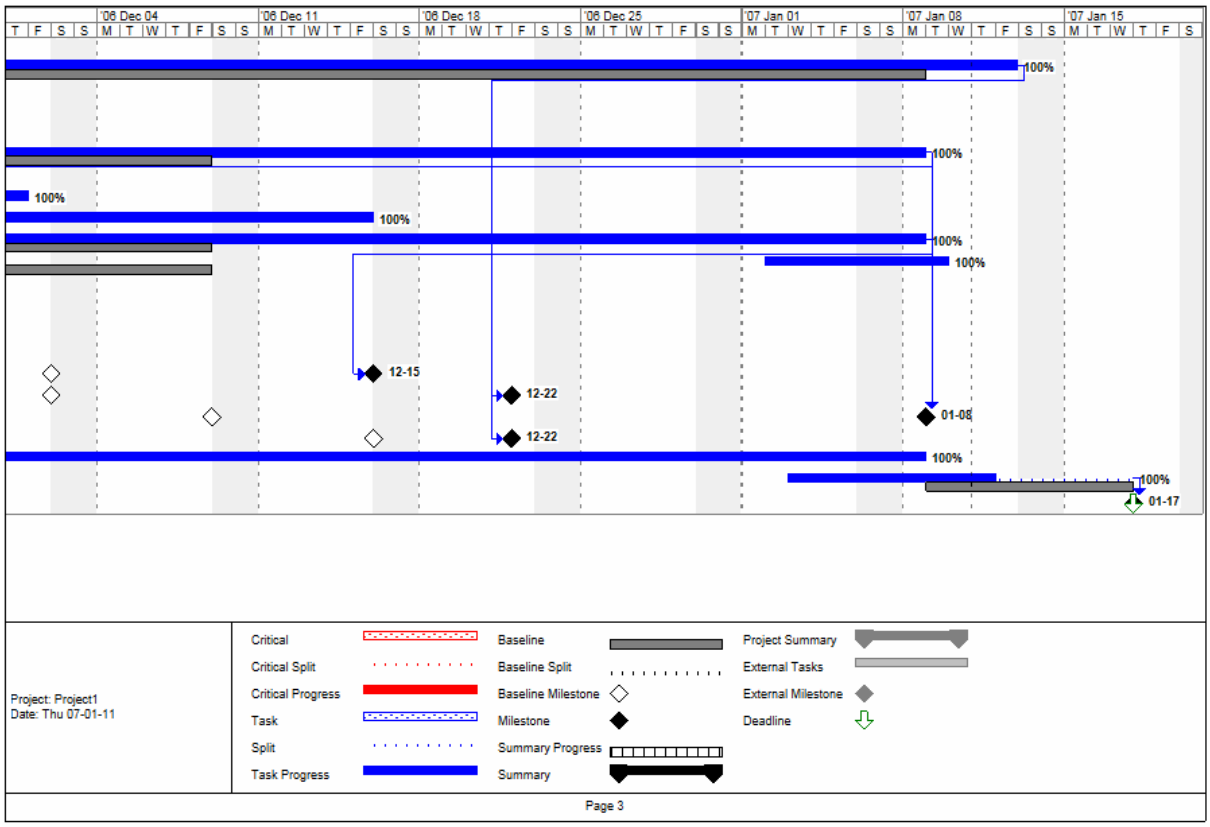
Appendix B: Time Schedule with milestones

ID	ID	Task Name	Duration	Start	Finish
1	1	Feasibility Study	9 days	Mon 06-09-18	Thu 06-09-28
2	2	Documentation	83 days	Wed 06-09-20	Fri 07-01-12
3	3	Initial system requirements	10 days	Tue 06-09-26	Mon 06-10-09
4	4	System architecture	25 days	Mon 06-10-09	Fri 06-11-10
5	5	Develop initial prototype	15 days	Mon 06-10-16	Fri 06-11-03
6	6	Program the mobile application/database	57 days	Fri 06-10-20	Mon 07-01-08
7	7	Validate build 1 (initial prototype)	10 days	Mon 06-10-30	Fri 06-11-10
8	8	Usability testing 1 (on paper)	12 days	Wed 06-11-15	Thu 06-11-30
9	9	User portal	31 days	Fri 06-11-03	Fri 06-12-15
10	10	Develop final solution	32 days	Fri 06-11-24	Mon 07-01-08
11	11	Validate and usability test final	6 days	Tue 07-01-02	Tue 07-01-09
12	12	ASP.NET platform, login/information	0 days	Fri 06-11-03	Fri 06-11-03
13	13	Database triggers	0 days	Fri 06-11-03	Fri 06-11-03
14	14	J2ME application connection with the database	2 days	Fri 06-11-03	Tue 06-11-07
15	15	Coordinate system	10 days	Fri 06-11-10	Fri 06-11-24
16	16	Try to download and store some information on a POI	10 days	Fri 06-12-01	Fri 06-12-15
17	17	Be able to push and interact with a POI	14 days	Fri 06-12-01	Thu 06-12-21
18	18	J2ME application should be finished	0 days	Mon 07-01-08	Mon 07-01-08
19	19	First draft of documentation finished	5 days	Fri 06-12-15	Fri 06-12-22
20	20	Administration platform	36 days	Fri 06-11-17	Mon 07-01-08
21	21	Preparing presentation of project	7 days	Tue 07-01-09	Wed 07-01-17
22	22	Presentation of the project	0 days	Wed 07-01-17	Wed 07-01-17





Appendix B: Time Schedule with milestones



- 30th October – ASP.NET platform, login/ information
- 30th October – Database triggers
- 1st November – J2ME application connected with the database
- 10th November – Coordinate system
- 17th November – Administration platform, WAP page, user portal
- 1st December - Try to download and store some information on a POI.
- 1st December – Be able to push and interact with a POI
- 8th December – Finish with J2ME application
- 15th December – First draft of documentation finished
- 17th January - Presentation of the project

Appendix C: Mobile platform

User scenario:

The user first connects to the web page where the application is stored. This is done via the GPRS and WAP. The user downloads the map application to their java compatible mobile phone. The java application is stored in the free memory of the phone. When the user starts the application he/she can look at the map of the city or update the skins. The application asks the user if he/she wants to update every time the user starts the application. When the user first downloads the application there will be no skins installed, this has to be downloaded from the database. The information is accessible to the end user by connecting the java application via GPRS/WAP. The application connects with the SQL Server and checks if there is any new information to download. If there is any new information on the updates the user will be asked if they want to download the new updates. The user can navigate the map and zoom in and zoom out to get a better view of the map. The user chooses a skin from the available skin list in the menu. The user can't have more than *one* skin on the screen at the same time. The skins show icons on the mobile screen and the icons are showed by colors. The user can navigate between these icons and when an icon is selected relevant information is represented about the object.

Technical requirements:

1.1 Java-enabled (J2ME with MIDP 1.0 and CLDC 1.0)
1.2 Color-screen, standard resolution should be 128x160 pixels, but it will be expandable.
1.3 At least 3 Mb of internal memory and the application should be within 1mb.
1.4 An apache server that runs the Servlet that connects with the database.
1.5 GPRS
1.6 Wap 2.0

User requirements:

1.1 A java enabled phone with a color screen and enough free memory. It should also have GPRS, WAP and be compatible with MIDP 1.0 and CLDC 1.0.
1.2 The user usually needs administration rights to install the java application on the mobile phone.

Functional

1.1 Start the application
1.2 Establish a connection with the database
1.3 The user accepts the confirmation of the download
1.4 Updates the application
1.5 Change the skins
    1.5.1 Scroll between the skins
    1.5.2 Accept the skin
1.6 Move a pointer to navigate the map
    1.6.1 Move the pointer around a big map
    1.6.2 Move the pointer around a small map
1.7 Click with the pointer on a point of interest
    1.7.1 Show shop name
    1.7.2. Show address
    1.7.3 Opening hours
    1.7.4 Telephone number
    1.7.5 Comments
1.8 Show the help menu
1.9 Quit the application

Appendix C: Requirements – Mobile platform

2.1 Scroll between all points of interest
    2.1.1 Show where the POI resides on the map
2.2 Keywords to find the right skins
2.3 Change the language of the application

Non-functional

1.1 The user should get the latest updates
1.2 The same commands and functions should be accessible on different mobile phones
1.3 Many users can update at the same time
1.4 The update should not take more than 10 seconds
1.5 It shouldn’t take more than 5 seconds to scroll on the detailed map

Appendix C: Administration platform

User scenario:

The client (stores/tourist offices) sends in information to the database by connecting to the web server. To connect to the web server, the client needs to log in with the necessary password and login name to send in the information. To easier transfer the data to the database the client has to fill in a data form. There is also a map where the store/company could pin point the location of the store on a similar map that's used in the java application. The information is maintained by the system administrators, who will have to accept the clients and maintain the information that the clients put in to the database.

Technical requirements:

1.1 Web page (web server)
1.2 SQL Server (Connection between the web server and the database)
1.3 Database
1.4 HTML, ASP.net, Java

User requirements

1.1 Access to the Internet through a Web browser, i.e. Internet Explorer or Mozilla Firefox etc.
1.2 A correct password and login, which they will get when they register.

Functional (for clients)

1.1 Register Client:
- 1.1.1 Register Store name, max 20 characters
- 1.1.2 Register Address, max 50 characters
- 1.1.3 Register Opening hours, max 30 characters
- 1.1.4 Register Telephone number, max 15 characters
- 1.1.5 Register Contact person, max 30 characters
- 1.1.6 Register Mail, max 40 characters
- 1.1.7 Register the x and y position of the event on a map, max 8 characters
- 1.1.8 Register type of event, example if it's a restaurant or hotel
- 1.1.9 Accept the registration
- 1.1.20 Receive a mail about the registration

1.2 Retrieve the lost password
1.3 Login the client
1.4 Register comments
- 1.4.1 Delete old comments
- 1.4.2 Edit old comments
- 1.4.3 Choose the store
- 1.4.4 Register max 400 characters in the comments
- 1.4.5 Register start and stop date for comments
- 1.4.6 Accept the registration

1.5 Register new shop
- 1.5.1 Register Store name, max 20 characters
- 1.5.2 Register Address, max 50 characters
- 1.5.3 Register Opening hours, max 30 characters
- 1.5.4 Register Telephone number, max 15 characters
- 1.5.5 Register Contact person, max 30 characters
- 1.5.6 Register Mail, max 40 characters
- 1.5.7 Register the x and y position of the event on a map, max 8 characters
- 1.5.8 Register type of event, example if it's a restaurant or hotel
- 1.5.9 Accept the registration

1.6 Update information on a shop
- 1.6.1 Choose store
- 1.6.2 Update Store name, max 20 characters
- 1.6.3 Update Address, max 50 characters
- 1.6.4 Update Opening hours, max 30 characters
- 1.6.5 Update Telephone number, max 15 characters
- 1.6.6 Update Contact person, max 30 characters
- 1.6.7 Update Mail, max 40 characters
- 1.6.8 Update the x and y position of the event on a map, max 8 characters
- 1.6.9 Update type of event, example if it's a restaurant or hotel
- 1.6.10 Accept the update
- 1.6.11 Cancel the update

1.7 Delete the shops
1.8 Change the password
1.9 Log out the client
2.1 Register new temporary event
- 2.1.1 Register Store name, max 40 characters
- 2.1.2 Register Address, max 30 characters
- 2.1.3 Register Opening hours, max 30 characters
- 2.1.4 Register the x and y position of the event on a map
- 2.1.5 Register max 400 characters in the comments
- 2.1.6 Register start and stop date for comments
- 2.1.7 Accept the registration

Non-Functional (for clients)

1.1 Portability; it should look the same and work on as many web browsers as possible
1.2 The clients should only be able to log in to their own account

Functional (for system administrators)

1.1 Login Admins
1.2 Create new clients
- 1.2.1 Register Client name
- 1.2.2 Register Store name, max 20 characters
- 1.2.3 Register Address, max 50 characters
- 1.2.4 Register Opening hours, max 30 characters
- 1.2.5 Register Telephone number, max 15 characters
- 1.2.6 Register Contact person, max 30 characters
- 1.2.7 Register Mail, max 40 characters
- 1.2.8 Register the x and y position of the event, max 8 characters
- 1.2.9 Register type of event, example if it's a restaurant or hotel
- 1.2.10 Accept the registration

1.3 List all clients
1.4 Delete the clients
- 1.4.1 Delete the clients
- 1.4.2 Delete the shops

1.5 Log out
2.1 Search for the shops
2.2 Edit clients information
2.3 Comments
- 2.3.1 Delete comments
- 2.3.2 Edit comments

Appendix C: Administration platform

Non-Functional (for system administrators)

1.1 Portability; it should look the same and work on as many web browsers as possible

1.2 Only the system administrators can create a new user

Appendix C: User portal

User scenario:

A web page where the user can download the application to the java enabled mobile phone. This page is separated from the administrative platform and the updates. On this web page the user can look at a demo of the application and test the basic GUI of the application to get more familiar with the system. On the server there are two separated files, a JAR file and JAD file. On some phones the JAD file is necessary; otherwise the phone won't work correctly with the application. The files could be downloaded to your computer or to your mobile phone directly. If the files are downloaded to the computer the user will have to transfer them with Bluetooth, IrDA, or serial cable. The user downloads the application by using GPRS and to make this simpler for the user, the user portal will also have a WAP page where the links to the files are shown.

Technical requirements:

1.1 Web page
1.2 HTML
1.3 Store the application (on a Server)
1.4 WAP page

User requirements:

1.1 The user should have a Java enabled phone with GPRS connection in order to connect to the WAP page
2.1 A computer with access to the Internet and a Bluetooth, or IrDA, sender on the computer.
2.2 A mobile phone with a Bluetooth, or IrDA, receiver. Connection could be established t through a serial cable.

Functional requirements

1.1 Access a Web page or WAP page
1.2 Use a demo of the J2me application
1.3 Download the application
1.3.1 Download the application to the mobile application
1.3.2 Download the application to the computer
1.4 Show the help screen
1.5 Extensive information about the application

Non-functional requirements

1.1 Easy to find and download the application
1.2 Portability; it should look the same and work on as many browsers as possible

Appendix D: Risks

Risk identification

Risk Type	Possible risks
Technology	• The j2me application is too big for the mobile phones we are using. • The j2me application can't communicate with the database correctly. • The maps are not visible enough on our mobile phones.
People	• Inexperienced people, people who don't have enough skills to accomplish the tasks that we need. • Language barriers; people speak different language and it could be difficult to always understand each other.
Tools	• Netbeans is not efficient enough for our kind of application.
Requirements	• The requirements are not evolved enough. • The requirements changes during the project.
Estimation	• The time schedule and the milestones are not achievable. • The size of the software is underestimated.

Risk analyze

Risk	Probability	Effect
The j2me application is too big for the mobile phones we are using.	Medium	Catastrophe
The j2me application can't communicate with the database correctly.	Medium	Catastrophe
The maps are not visible enough on our mobile phones.	Medium	Serious
Inexperienced people, people who don't have enough skills to accomplish the tasks that we need.	Medium	Catastrophe
Language barriers; people speak different language and it could be difficult to always understand each other.	Low	Serious
Netbeans is not efficient enough for our kind of application.	Low	Serious
The requirements are not evolved enough.	High	Serious
The requirements changes during the project.	High	Tolerable
The time schedule and the milestones are not achievable.	Medium	Serious
The size of the software is underestimated.	Medium	Serious

Appendix D: Risks

Risk planing

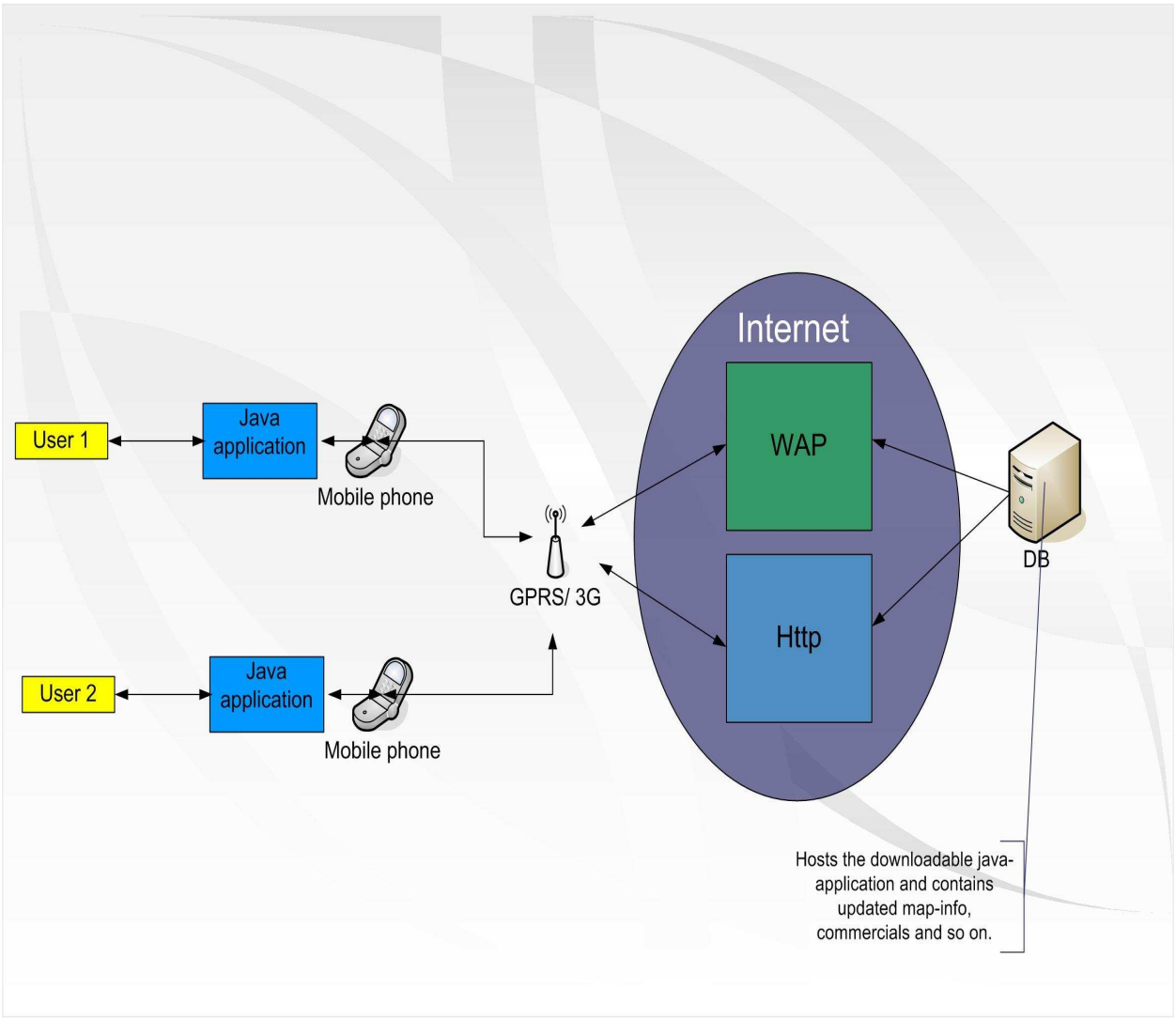
Risk	Type of strategi	Strategy
The j2me application is too big for the mobile phones we are using.	Minimization strategy	Restrict the number of POI (points of interest) your application could have and bring the quality of the map down.
The j2me application can't communicate with the database correctly.	Contingency plan	The updates will not work; the themes and skins have to be with the application.
The map is not visible enough on our mobile phones.	Minimization strategy	Delete the unimportant stuff and try to highlight the roads on the map.
Inexperienced people, people who don't have enough skills to accomplish the tasks that we need.	Avoidance strategy	Get help from the teachers and the tutor.
Language barriers; people speak different language and it could be difficult to always understand each other.	Contingency plan	We will better understand each other if we draw a lot and a few words should always come through.
Netbeans is not efficient enough for our kind of application.	Minimization strategy	We use other IDEs for the J2me programming, for an example IBM eclipse.
The requirements are not evolved enough.	Avoidance strategy	Ask ourselves if we have requirements that are enough and satisfying for our project.
The requirements changes during the project	Contingency plan	Adapt to the new requirements and save the old work; it could still be useful for the project.
The time schedule and the milestones are not achievable.	Minimization strategy	Cut out functions that we feel are not necessary for the application, if we see that we will not have time to make this function in the application.
The size of the software is underestimated.	Minimization strategy	Same back up plan as the suggestion above.

Appendix D: Risks

Risk monitoring

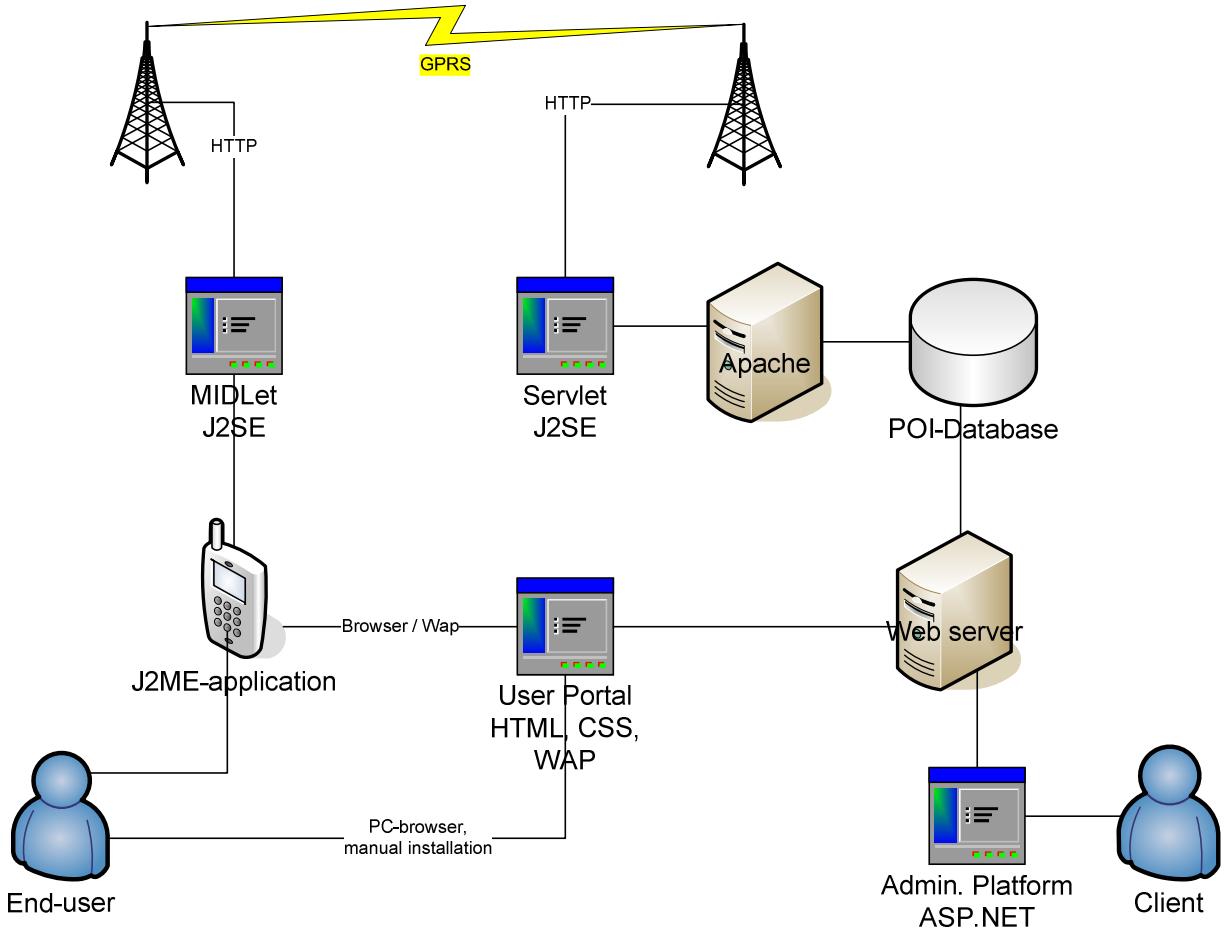
Risk type	Potential indicators
Technology	During our tests the mobile phones that we have for our disposal is not working correctly with our application.
People	We don't get anywhere with the project. The tasks are not completed.
Tools	The application is too slow to work with and the emulators are not working correctly.
Requirements	People find it difficult to work with the requirements; it's too vague for them.
Estimation	The milestones and the schedule are not finished in time.

Appendix E: First version



Appendix E: High level system architecture

High level system architecture

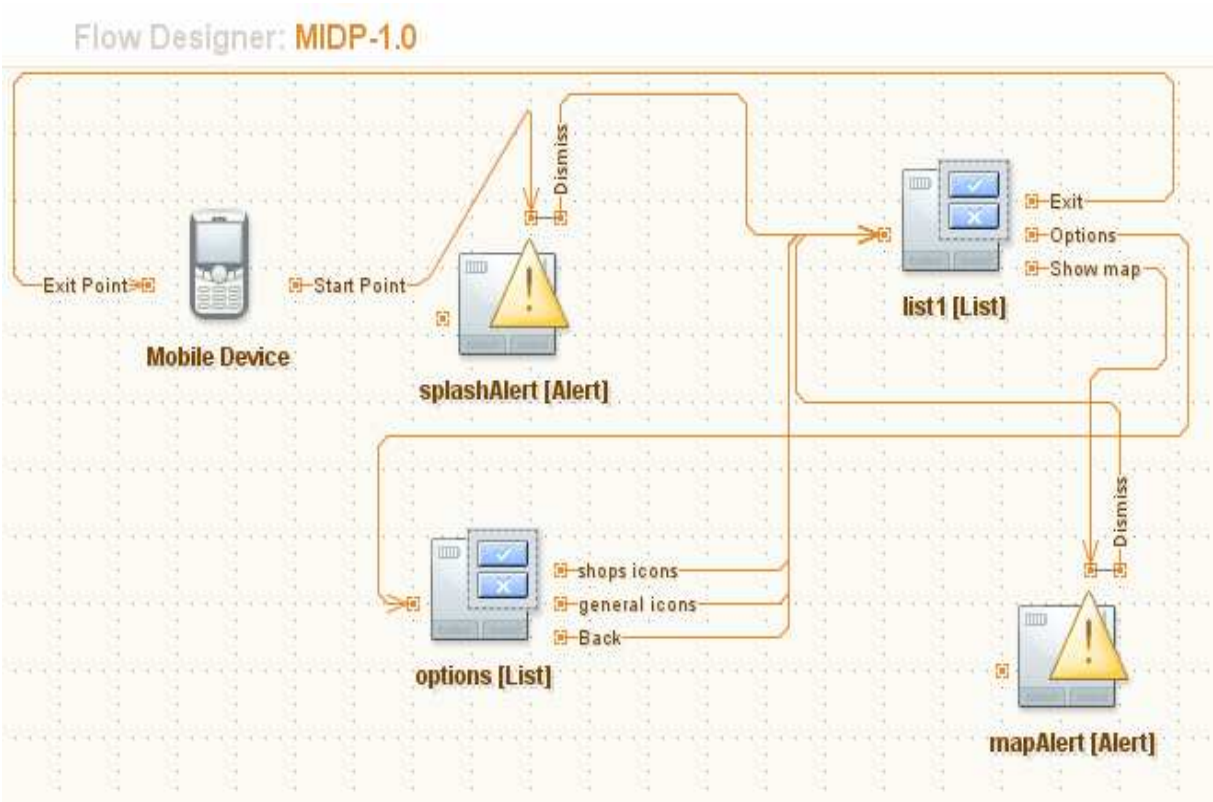


Appendix F: Table code and restrictions

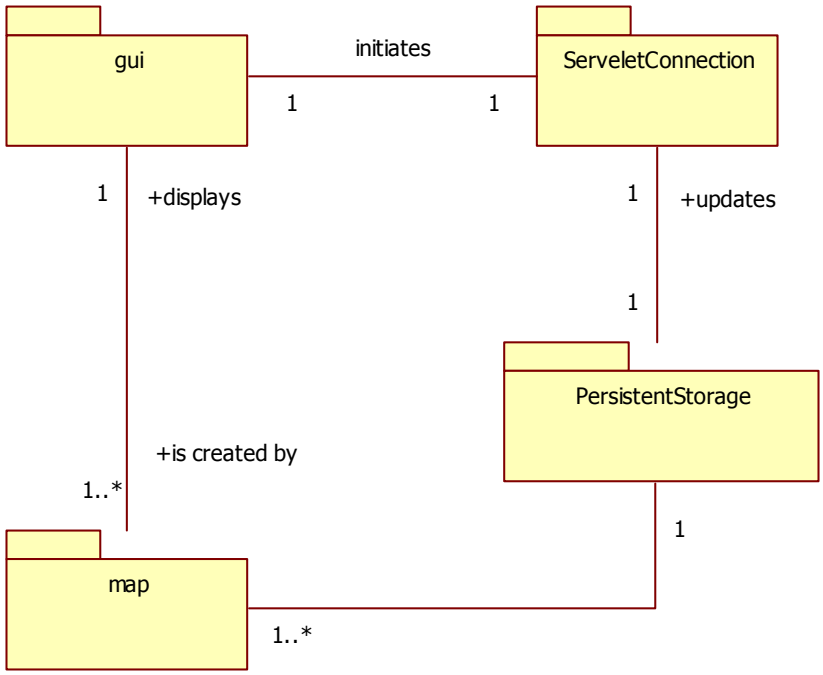
```
CREATE table Shop  (Id int IDENTITY PRIMARY KEY,
                    UserId uniqueidentifier NOT NULL,
                    Name varchar (20) NOT NULL,
                    Address varchar (50),
                    OpeningHours varchar (40),
                    ContactPerson char (30),
                    Phone char (15),
                    Mail varchar (40),
                    X int NOT NULL,
                    Y int NOT NULL,
                    CONSTRAINT ID_Shop_pk
                    CONSTRAINT ID_Users_Shop_fk
                    FOREIGN KEY (UserId) REFERENCES  aspnet_Users (UserId);

CREATE table Comments     (Id int IDENTITY PRIMARY KEY,
                           ShopId int,
                           Comments VARCHAR(400) NOT NULL,
                           StartDate datetime DEFAULT GETDATE (),
                           StopDate datetime DEFAULT GETDATE() + 365,
                           UpdateTime datetime DEFAULT GETDATE(),
                           CONSTRAINT Id_Shop_Comments_fk
                           FOREIGN KEY (ShopId) REFERENCES Shop (Id));

CREATE table Object       (Id int IDENTITY PRIMARY KEY,
                           Name CHAR(30),
                           Icon int NOT NULL);

CREATE table Objects_and_Shops       (Id int IDENTITY PRIMARY KEY,
                                      ObjectId int,
                                      EventId int,
                                      ShopId int NOT NULL,
                                CONSTRAINT ID_Object_Objects_and_Shops_fk
                                      FOREIGN KEY (ObjectId) REFERENCES Object (Id),
                                CONSTRAINT ID_Event_Objects_and_Shops_fk
                                      FOREIGN KEY (EventId) REFERENCES Event (Id),
                                CONSTRAINT ID_Company_fk
                                      FOREIGN KEY (ShopId) REFERENCES Shop (Id) ,
                                CONSTRAINT Id_Events_Objects_and_shops_check_not_null
                                   CHECK ( (ObjectId is NOT NULL AND EventId is NULL) OR
                                   (EventId is NOT NULL AND ObjectId is NULL)
                                   OR (ObjectId is NOT NULL AND EventId is NOT NULL)));

CREATE table Event   (Id int IDENTITY PRIMARY KEY,
                      Name varchar (40) NOT NULL,
                      Address varchar (30),
                      X int NOT NULL,
                      Y int NOT NULL,
                      Comments VARCHAR(400) NOT NULL,
                      StartDate datetime DEFAULT GETDATE () NOT NULL,
```

```
StopDate datetime DEFAULT GETDATE () NOT NULL,
OpeningHours varchar (40));
```

Appendix G: Early flow design of the J2ME application

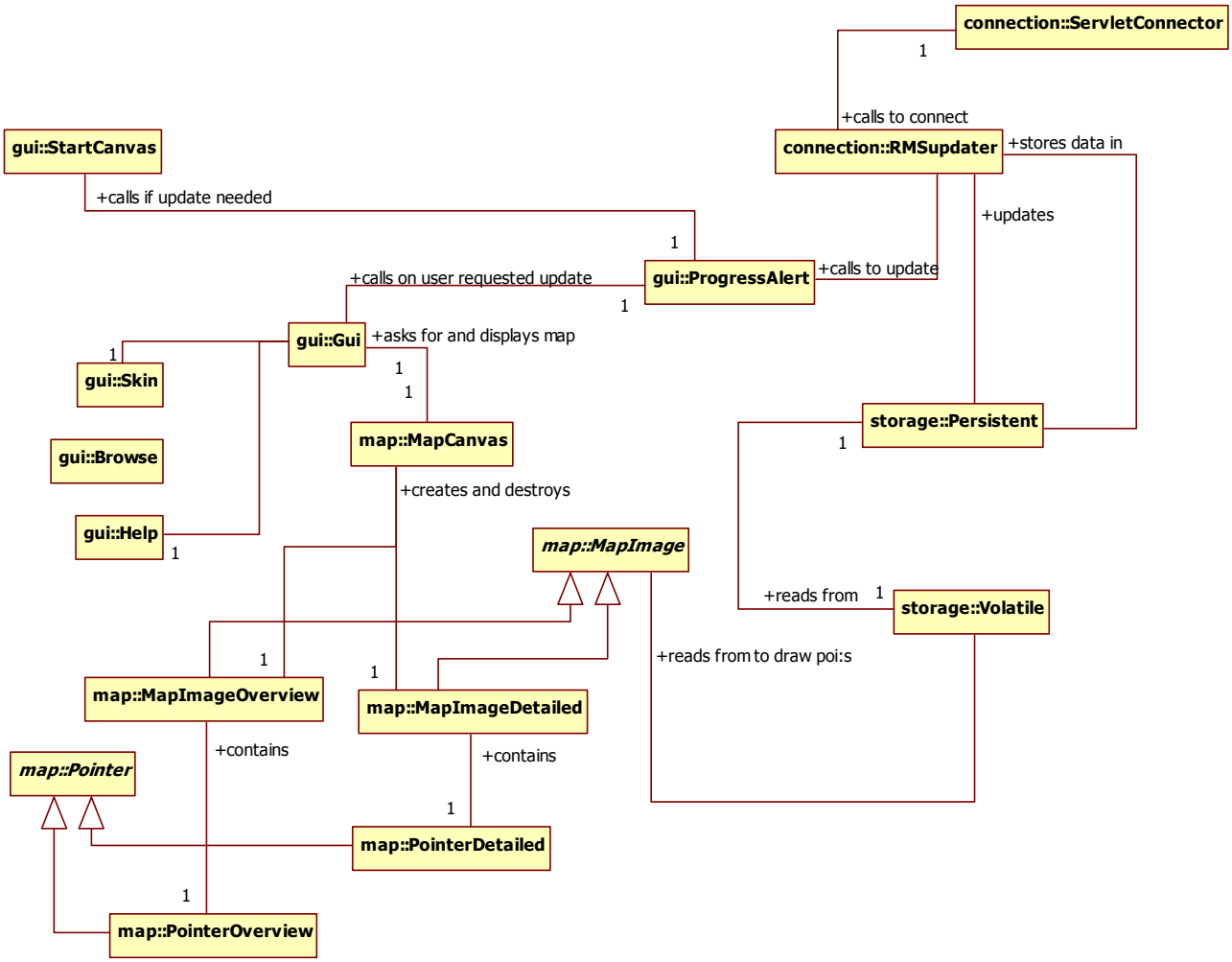


Appendix H: initial class diagram of the J2ME application



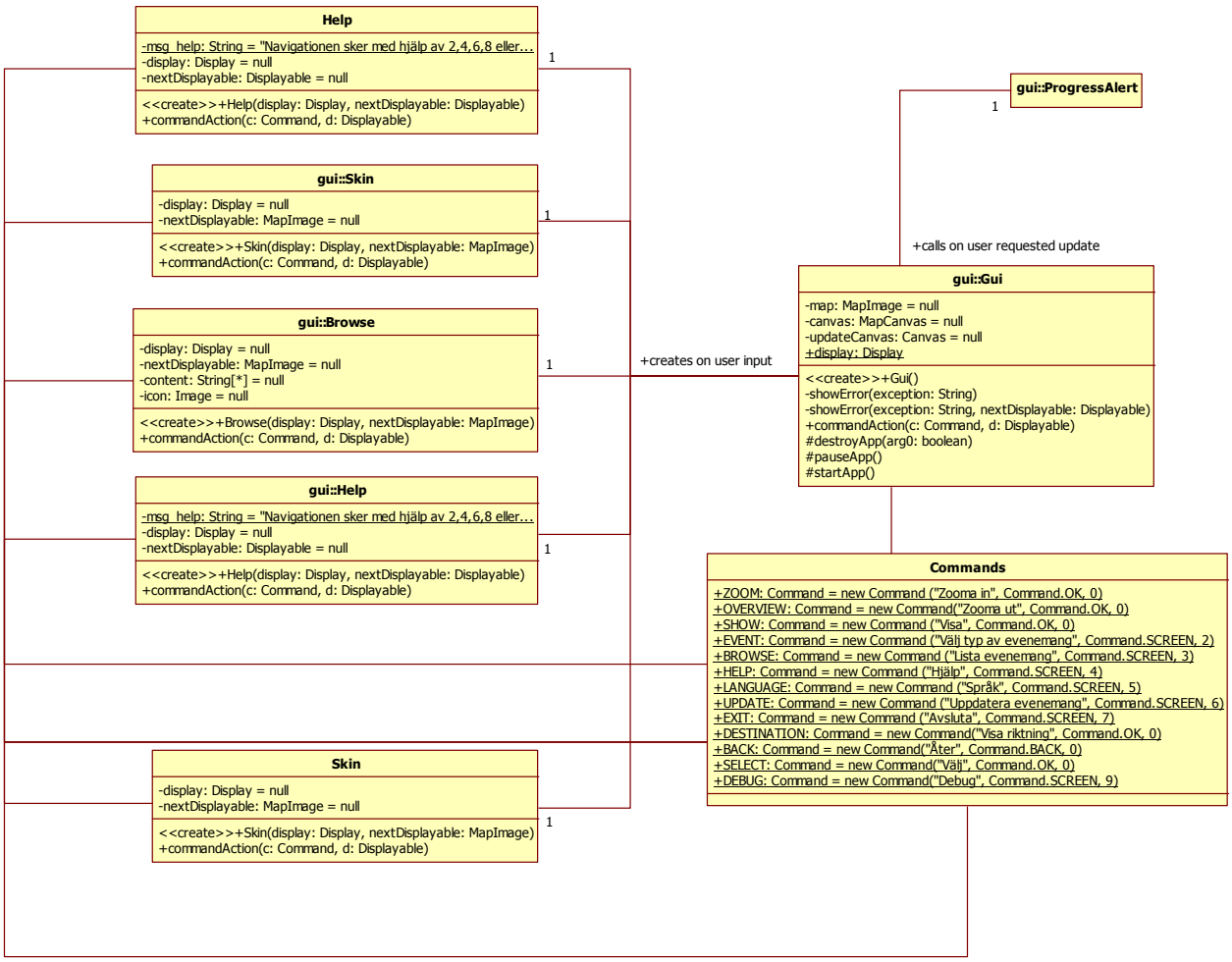
Appendix H: Final class diagrams

Overview



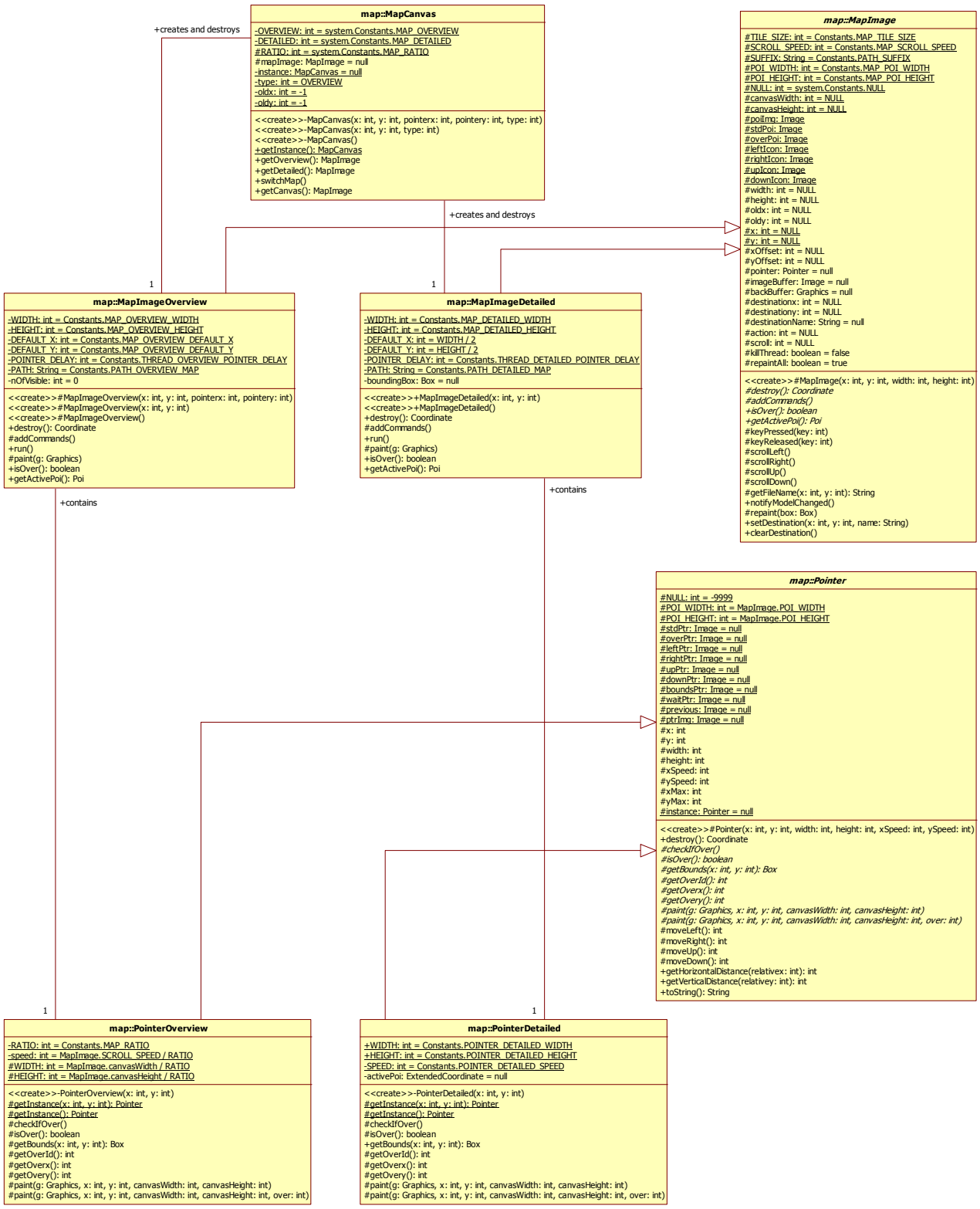
Appendix H: Final class diagrams

Package: gui


Help
-msg_help: String = "Navigationen sker med hjälp av 2,4,6,8 eller...
-display: Display = null
-nextDisplayable: Displayable = null
<<create>>+Help(display: Display, nextDisplayable: Displayable)
+commandAction(c: Command, d: Displayable)
gui::Skin
-display: Display = null
-nextDisplayable: MapImage = null
<<create>>+Skin(display: Display, nextDisplayable: MapImage)
+commandAction(c: Command, d: Displayable)
gui::Browse
-display: Display = null
-nextDisplayable: MapImage = null
-content: String[*] = null
-icon: Image = null
<<create>>+Browse(display: Display, nextDisplayable: MapImage)
+commandAction(c: Command, d: Displayable)
gui::Help
-msg_help: String = "Navigationen sker med hjälp av 2,4,6,8 eller...
-display: Display = null
-nextDisplayable: Displayable = null
<<create>>+Help(display: Display, nextDisplayable: Displayable)
+commandAction(c: Command, d: Displayable)
Skin
-display: Display = null
-nextDisplayable: MapImage = null
<<create>>+Skin(display: Display, nextDisplayable: MapImage)
+commandAction(c: Command, d: Displayable)
1
1
1
1
1
gui::ProgressAlert
1
+calls on user requested update
gui::Gui
-map: MapImage = null
-canvas: MapCanvas = null
-updateCanvas: Canvas = null
+display: Display
<<create>>+Gui()
-showError(exception: String)
-showError(exception: String, nextDisplayable: Displayable)
+commandAction(c: Command, d: Displayable)
#destroyApp(arg0: boolean)
#pauseApp()
#startApp()
+creates on user input
Commands
+ZOOM: Command = new Command ("Zooma in", Command.OK, 0)
+OVERVIEW: Command = new Command("Zooma ut", Command.OK, 0)
+SHOW: Command = new Command ("Visa", Command.OK, 0)
+EVENT: Command = new Command ("Välj typ av evenemang", Command.SCREEN, 2)
+BROWSE: Command = new Command ("Lista evenemang", Command.SCREEN, 3)
+HELP: Command = new Command ("Hjälp", Command.SCREEN, 4)
+LANGUAGE: Command = new Command ("Språk", Command.SCREEN, 5)
+UPDATE: Command = new Command ("Uppdatera evenemang", Command.SCREEN, 6)
+EXIT: Command = new Command ("Avsluta", Command.SCREEN, 7)
+DESTINATION: Command = new Command("Visa riktning", Command.OK, 0)
+BACK: Command = new Command("Åter", Command.BACK, 0)
+SELECT: Command = new Command("Välj", Command.OK, 0)
+DEBUG: Command = new Command("Debug", Command.SCREEN, 9)

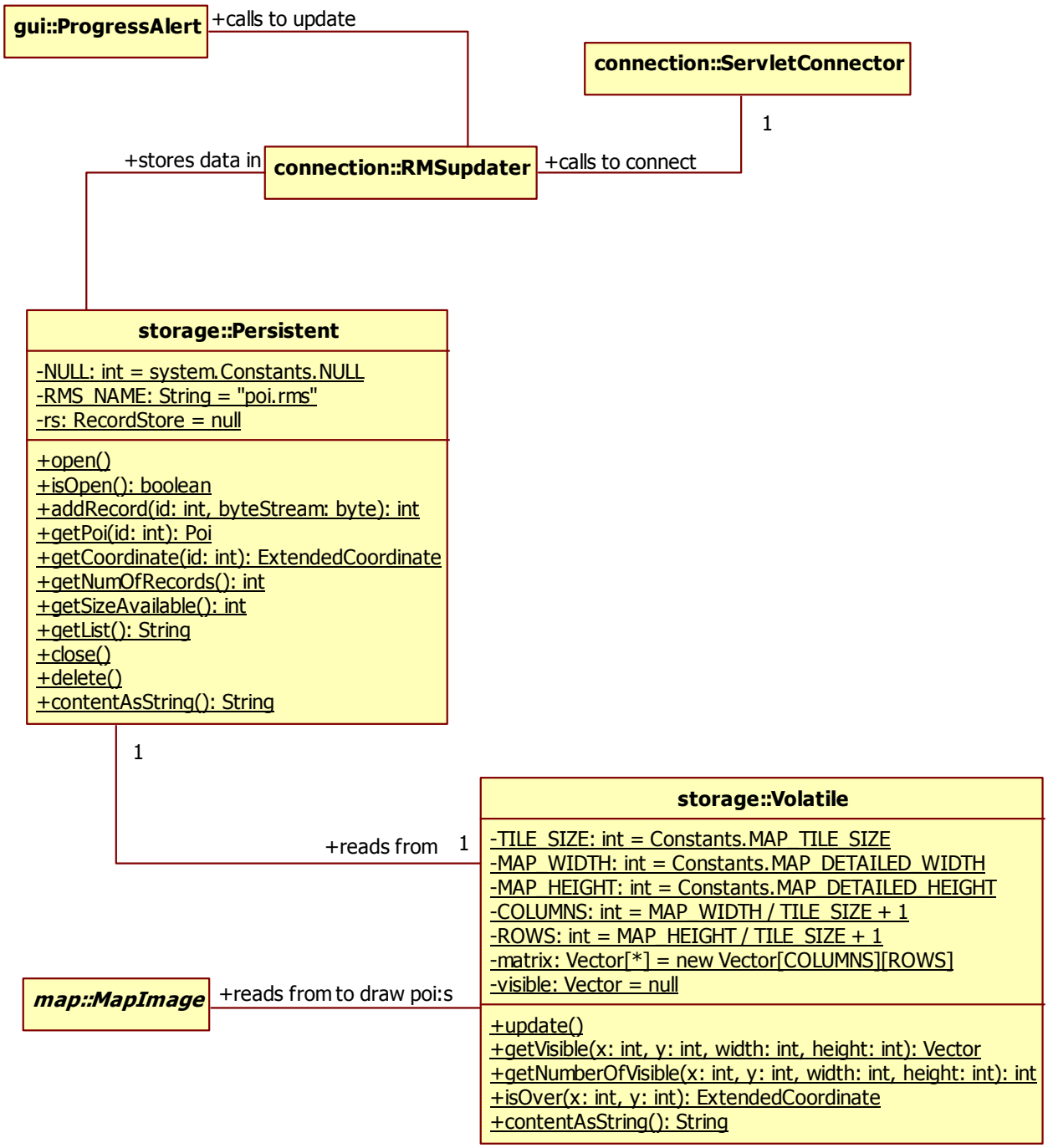
Appendix H: Final class diagrams

Package: map



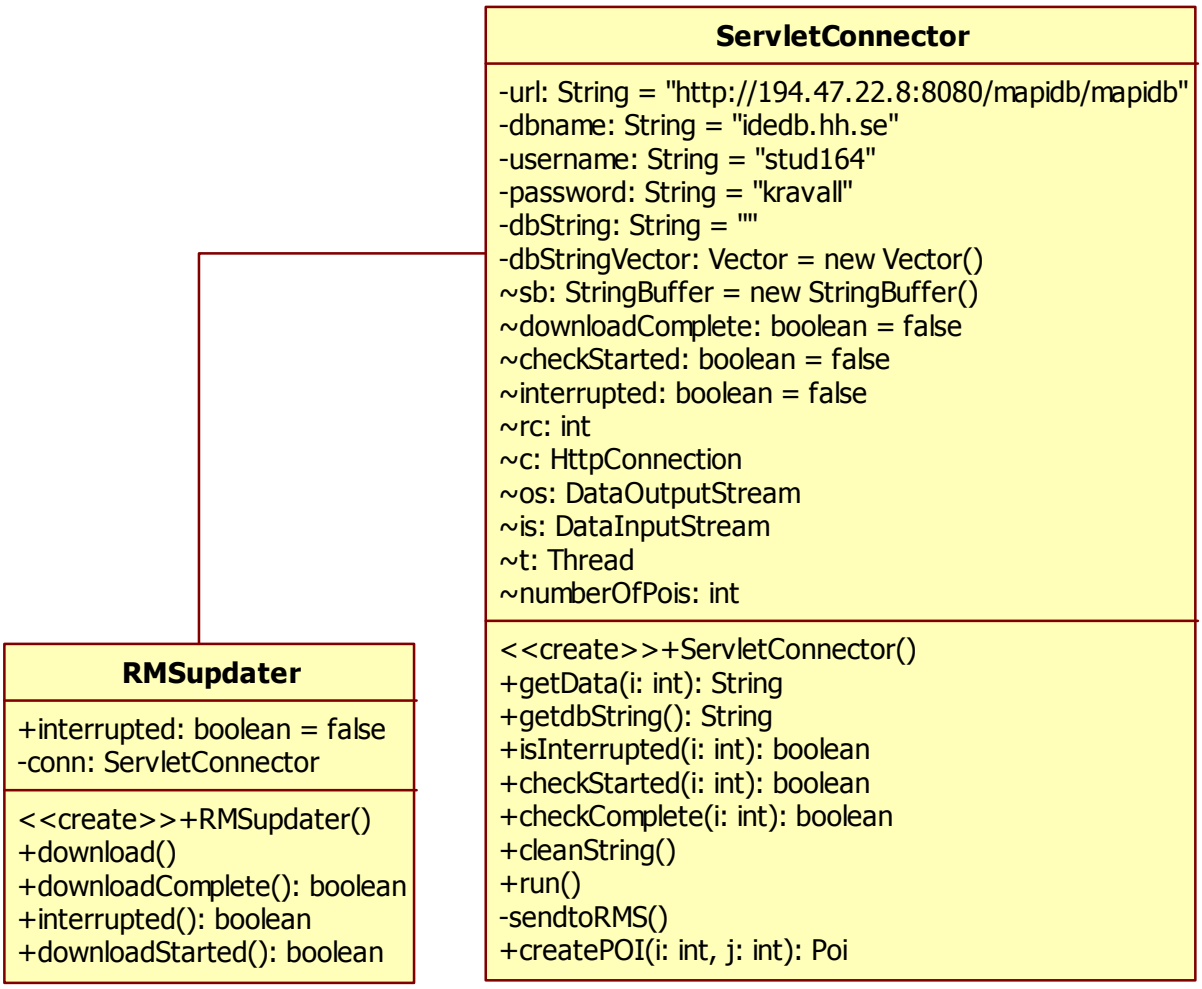
Appendix H: Final class diagrams

Package: storage



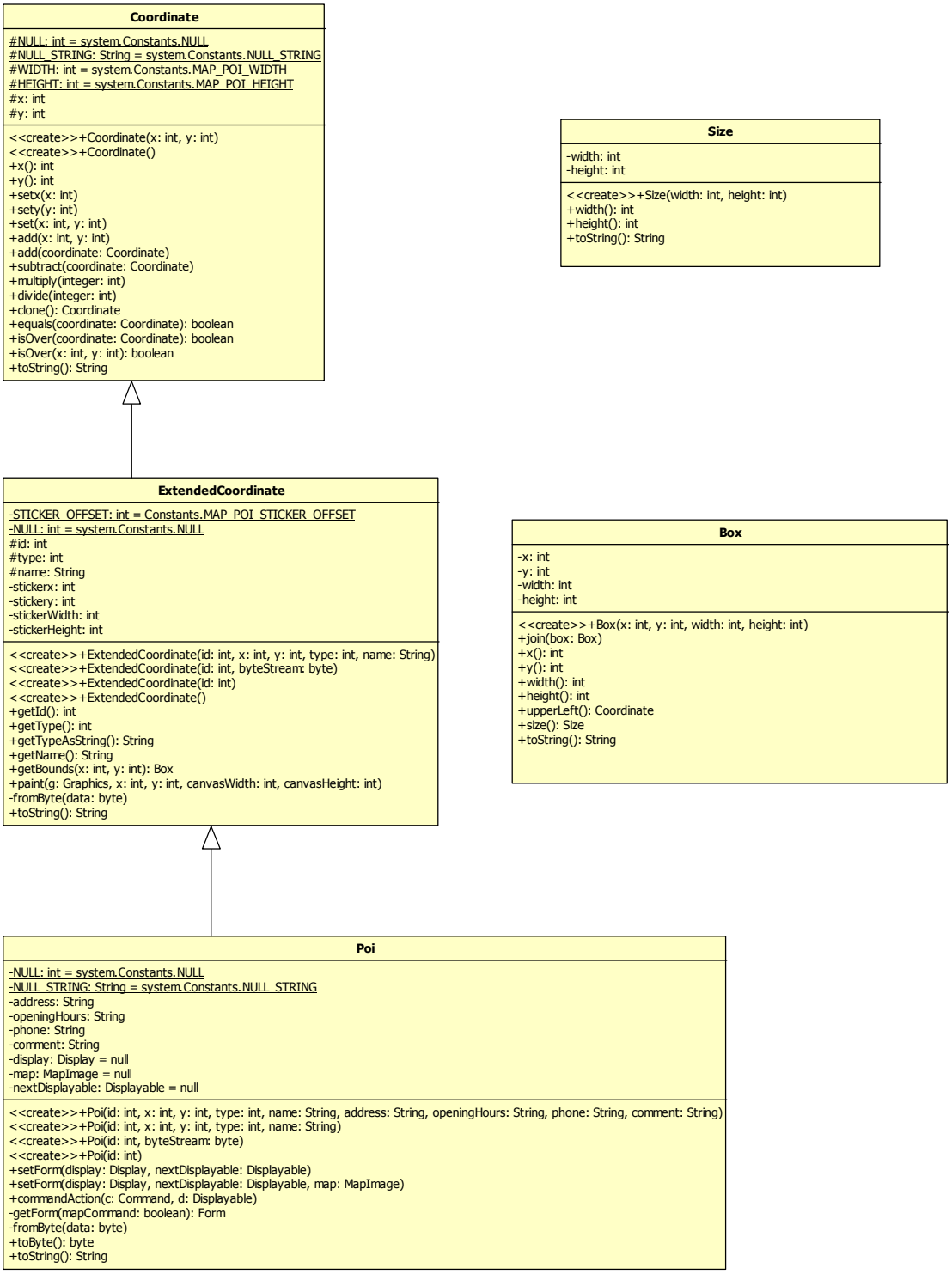
Appendix H: Final class diagrams

Package: connection



Appendix H: Final class diagrams

Package: struct



Appendix I: The first prototype

1

MAPI

Loading... 50%

2

Kontrollera uppdateringar

Ja Nej

3

Laddar ner uppdatering.. 50%

4

Meny

- Visa karta
- Uppdateringar
- Språk/Language
- Hjälp

Välj Avsluta

5 Språk/Language

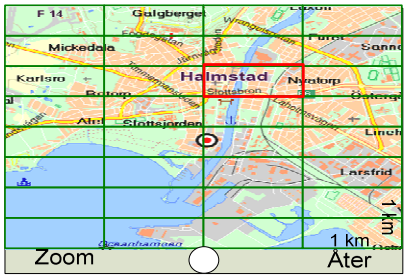
- Svenska
- English

Välj Åter

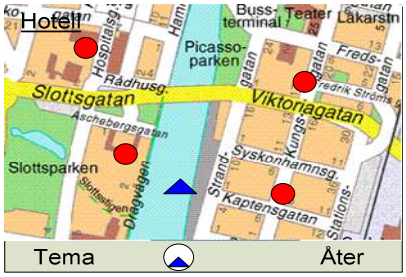
6 Hjälp

Navigationen sker med hjälp med av 2,4,6,8 eller joystick för att flytta markör.
Du använder softkey:s (yes and no) för att acceptera ditt val eller gå tillbaka.
När det finns en tredje ikon i mitten av skärmen så kan du använda 0 för att bekräfta/ändra

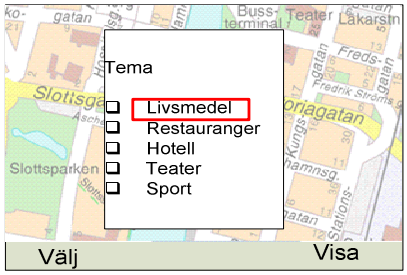
Åter



7 Zoom Åter



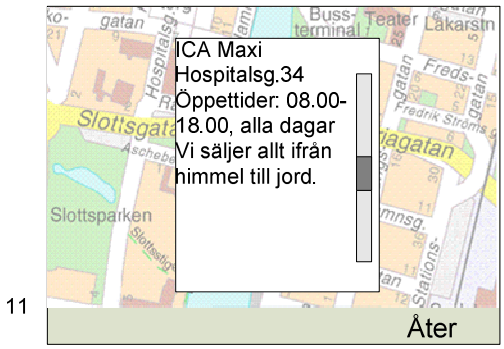
8 Tema Åter



9 Välj Visa

10 Visa Åter

Appendix I: First prototype of the GUI



1. When the user first starts the application he/she sees the loading screen of the application.
2. When it loads, the user is asked whether he/she wants to do updates. If the user accepts then they go to the loading screen of the updates, or if they choose no they will go to the main menu (screen 4).
3. When the connection with the database is established, the application first checks if the user has the latest updates, if they have, the updates will not be downloaded. When they download the updates, the update screen shows the user progress, how much they have downloaded. When the download is finished, it automatically goes to the main menu (screen 4).
4. This is the main menu. Here the user has four different choices to make. First, the user can select to “view the map”. Second, if the user wants to do updates it’s possible to do this again. The third option is for changing language. The user could choose between Swedish, which is the default option, and English. The final option is “help”. If the user wants to quit the application it’s possible to do this with one of the softkeys, in this example with the right key. The left key is used for accepting an option.
5. This is the language screen. Here you choose between English and Swedish. The user uses the same control scheme for this menu.
6. The help screen describes a brief user manual. It displays information about how the user controls the application.
7. Now the user has chosen to view the map. When the map is in its default mode, the user can see the whole city map. The map is divided in to areas with in a grid (the scale on the bottom right shows that one square area is 1x1 km). The user can choose to zoom in to get a better view or exit to the main menu. If the user wants to change the area which he/she wants to see, the user navigates with the red rectangle to the left, right, up or down.
8. In the “zoomed in” screen the user can choose to see different objects by choosing different skins. In this example the user sees all the hotels in this area (represented by the red circles). The blue pointer is a marker that should be activated in order to navigate to a certain object to view its info. If the user wants to navigate to the next area, and not zoom out to do this, he/she must deactivate the marker (this could be done by using zero on your phone). This means that the blue pointer can’t be used to navigate to the next area. If the user wants to change the skins, they should press on the theme button. If they want to go back to the default map screen, they press back.

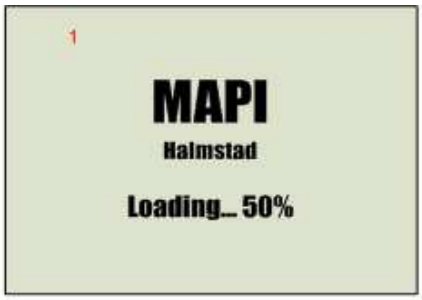
Appendix I: First prototype of the GUI

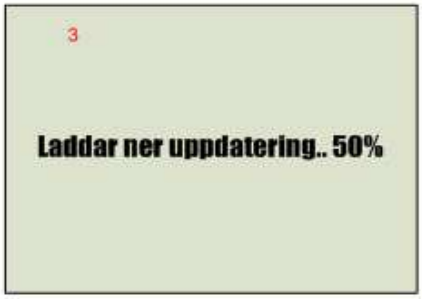
9. This is the theme selection screen (where the users choose the skins). The user sees a pop-up menu. This menu has many different objects that the user could choose by selecting the checkboxes and this is done by pressing the left softkey, in this case the option “choose”. When the user is happy with the changes they press “show” with the right softkey to accept their choice, the user then see the map with the objects selected.

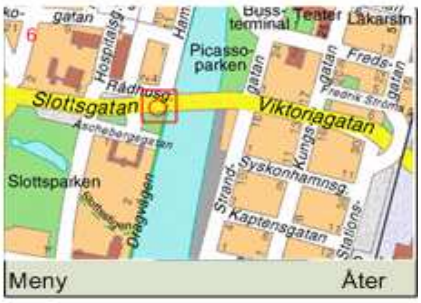
10. This screen explains what’s happening when the blue marker is activated and over a certain object. In this position it’s not possible to go the “theme” screen. In this position the user could only choose “show” with the left softkey. When this happens, an information screen about the object will be showed. The user can still go back to the default map screen or choose to deactivate the blue marker

11. In this screen the user sees information about the different objects that they selected with the blue marker, in this case a grocery store. The information displayed is usually name, address and opening hours. If the length of the message is too long for the mobile screen, the user can scroll with the “up” key or the “down” key. When the user has read all the information they can go back by pressing the right softkey, the “back” option.

Appendix I: The second prototype

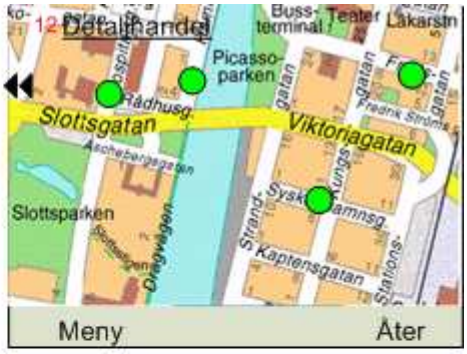






8
Hjälp
Navigationen sker med hjälp av 2,4,6,8 eller en joystick för att flytta markör.
Du använder softkey:s (yes and no) för att öppna upp en meny eller avsluta. Med select knappen (knappen i mitten) så väljer du, oftast, ditt val. För att visa en speciell typ av evenemang, exempelvis endast detaljhandel måste du trycka på "välj evenemang". För att titta på alla evenemang som finns kan du trycka på "alla evenemang"
Åter

Appendix I: The second prototype of the GUI

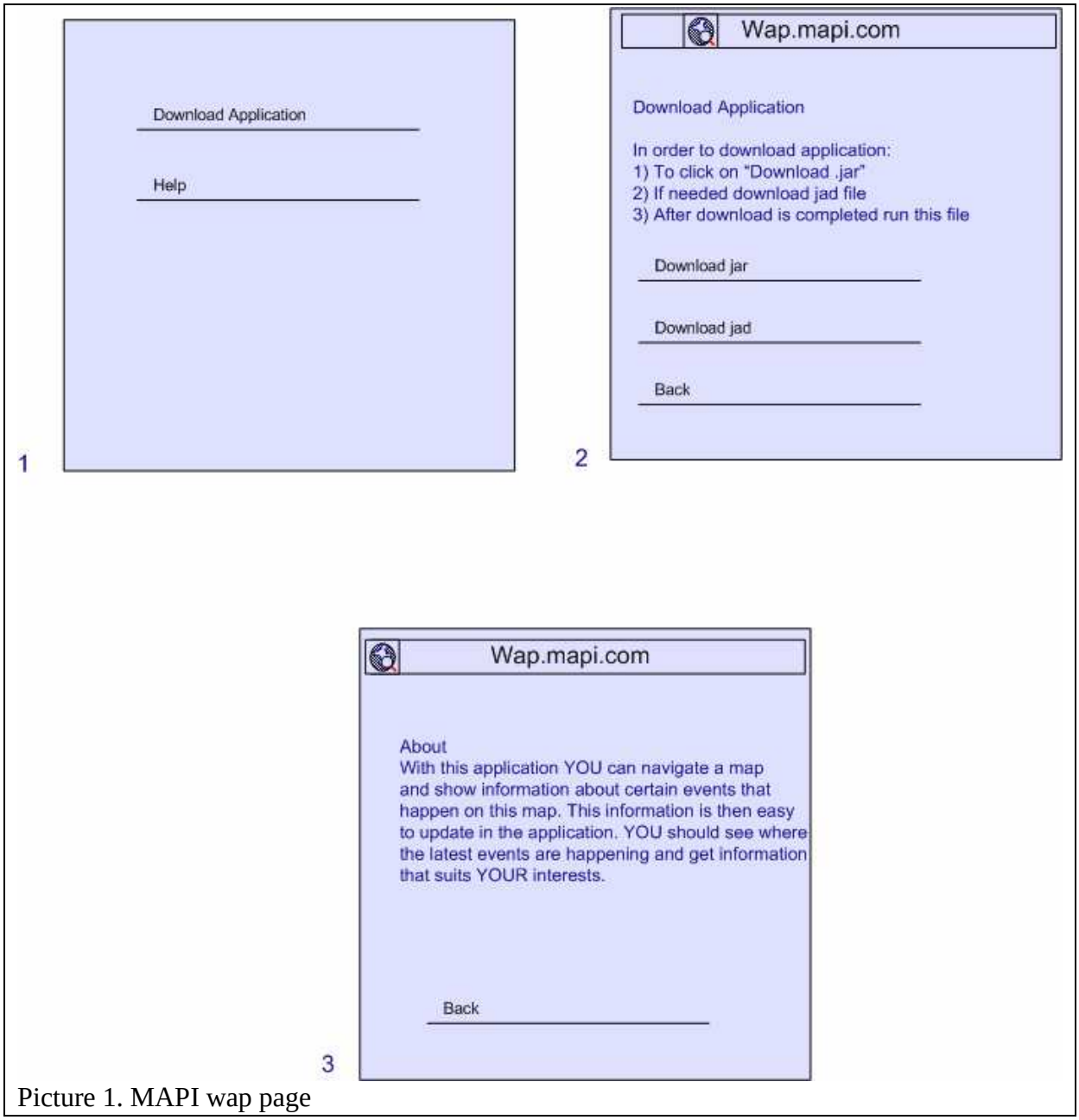


1. When the user first starts the application he/she sees the loading screen of the application.
2. When it loads, the user is asked whether he/she wants to do updates. If the user accepts then they go to the loading screen of the updates, or if they choose ‘no’ they will go to the map with the main menu (screen 5).
3. When the connection with the database is established, the application first checks if the user has the latest updates, if they have, the updates will take much quicker. When they download the updates the update screen shows the user progress; how much they have downloaded. When the download is finished, it moves to screen 4.
4. The user will have to press ‘OK’ when the update is finished. This will help them to understand that the download is finished and they will proceed to the main map and menu (screen 5)
5. This is the overview map with the main menu. The main menu will be a pop-up menu or a menu filling the full screen (it depends on the mobile phone used, we can’t really control it). We will try to have the main functions in the menu; this is simplified with the ‘Update’, ‘Choose theme’, ‘All themes’, ‘Language’, ‘Help’, The user will access this with the ‘left’ or the ‘right’ softkey. The ‘Exit’ button will, of course, exit the application. By using the ‘joystick’ or the ‘2’,’4’,’6’,’8’ keys the user can navigate the box in the overview map. The ‘select’ button can be used to choose ‘zoom’ and the user will then go the detailed map.
6. In the detailed screen the user can choose to see different objects by choosing different skins. In this example we don’t have any objects (because they will have to activate a skin first). The user could use the red marker to navigate to a certain object and view its info or they could navigate to the next area.

Appendix I: The second prototype of the GUI

7. This is the language screen. Here you choose between English and Swedish. When the user chooses English the main menu and the commands will all be in English and if they choose Swedish it will be vice versa. You access the language selection screen in the pop-up menu.
8. The help screen describes a brief user manual. It displays information about how the user controls the application. The user can access the help screen in the pop-up menu
9. This screen appears when the user has pressed on “choose event” in the menu. This menu has many different objects that the user could choose, but only one at a time, and this is done by pressing the ‘left softkey’ to accept the choice. When this is done the user will see the map with the appropriate skin and their objects (screen 10).
10. This screen explains what’s happening when the red marker is over a certain object. The user will see the name of a certain object and the icon will perhaps change a little bit in the design. In this position the user could choose “show” with the, in this case, the ‘select’ button. When this happens an information screen about the object will be shown (Screen 11)
11. In this screen the user sees information about the different objects that they selected with the red marker, in this case a retail store. The information displayed is usually name, address, phone number and comments. If the length of the message is too long for the mobile screen, the user can scroll with the “up” key or the “down” key. When the user has read all the information they can go back by pressing the ‘right’ softkey.
12. The user can also move to the next area of the detailed map with the red marker. When the red marker is close to the corner of the screen it will change its symbol to an arrow according to the side they are trying to scroll to.
13. [optional screen] If the user presses the ‘select’ button in the main menu on the “All event” command they will be able to see all the information about the skins and their objects.
14. [optional screen] This is almost the same screen as screen 11, but here the user can choose to scroll to the left or the right and show information about a certain object and then they should be able to see on the detailed map where the object resides.

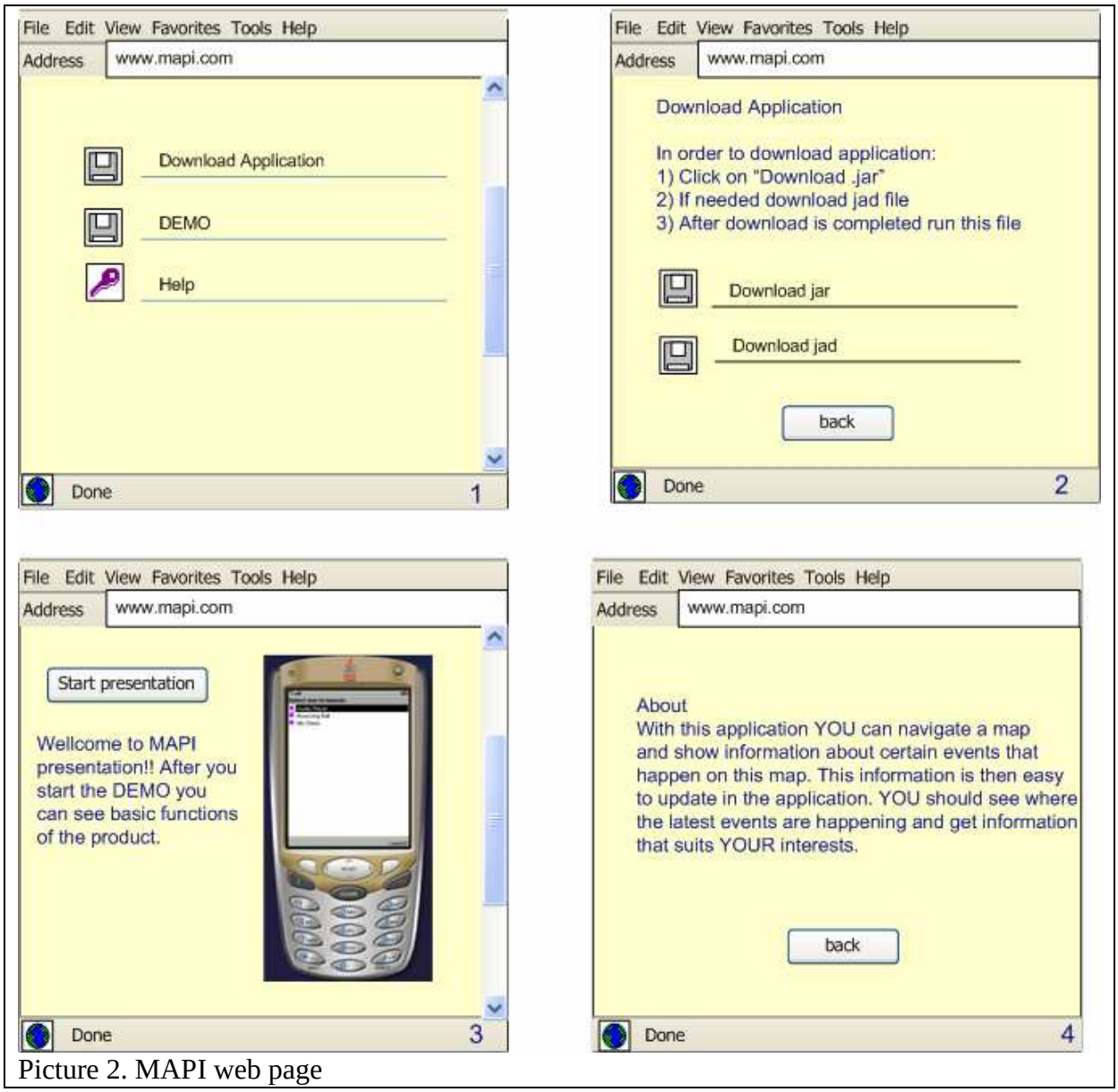
Appendix J: User portal design/description


Download Application
Help
1
Wap.mapi.com
Download Application
In order to download application:
1) To click on "Download .jar"
2) If needed download jad file
3) After download is completed run this file
Download jar
Download jad
Back
2
Wap.mapi.com
About
With this application YOU can navigate a map and show information about certain events that happen on this map. This information is then easy to update in the application. YOU should see where the latest events are happening and get information that suits YOUR interests.
Back
3

Picture 1. MAPI wap page

MAPI wap page can be found on this address: **http://www.utgren.com/wml/index.wml** When the address is entered the default main page is opened (picture 1, first screen) in which two options are displayed: “Download Application” and “Help”. If user clicks “Help” hyperlink, he/she will navigate to the description of the MAPI application (picture 1, third screen). By selecting “Download Application” hyperlink user is navigated to “Download application” screen, there is an ability to download jar and jad files by clicking on “Download jar” or “Download jad” correspondingly (picture 1, second screen). In addition, there is a short download instruction. Some mobile phones need both the jad file and the jar file installed in order to run the java application.

Appendix J: User portal design/description



Picture 2. MAPI web page

MAPI web page can be found on the address: http://www.utgren.com/mapi/ Default page is the first in the picture 2. There is a possibility to choose “Download application”, “Demo” and “Help”. By selecting the “Help” hyperlink a description of MAPI is opened (picture 2, fourth screen). If user clicks on “Demo”, demo screen is displayed; there is a short presentation of the MAPI system on a mobile phone (picture 2, third screen). By selecting “Download Application” hyperlink user is navigated to “Download application” screen, there is an ability to download jar and jad files by clicking on “Download jar” or “Download jad” correspondingly (picture 2, second screen).

Appendix K: Cognitive Walkthrough test

The action sequence needed for this task is specified by the user's action (UA1, UA2, etc) and the system's display or response (SD 1, SD 2, etc). The system display is written to see the response of the system but the evaluators also had the chance to see the response of the system by looking at the pictures in *appendix E*. We used three evaluators, Ega, Doma and Mats and Mattias was the coordinator of the test.

The question: Download and update the skins and show information about a grocery store that resides in the centre of Halmstad and then show the other grocery stores in the area left to the centre.

UA 1: Press the 'select' button, or the 'left' softkey.
SD 1: Display moves to the download page, a loading text appears and when the download is finished it moves to the 'start' menu.
UA 2: Press the 'select' button, or press the 'left' softkey.
SD 2: The overview map is shown and a red pointer is visible on the screen
UA 3: Press the 2,4,6,8 digits (or the joystick) and navigate to the centre of Halmstad and press the 'select' button or the 'left' softkey.
SD 3: The red pointer moves to the right position and then shows the inzoomed map.
UA 4: Press the select button or the 'left' softkey button.
SD 4: The 'skins' menu is showed on a new screen
UA 5: Press the 'select' button or the 'left' softkey button. Then press the right softkey.
SD 5: The display shows the inzoomed map with the grocery store icons on the map
UA 6: Press the 2,4,6,8 digits (or the joystick) and navigate to the nearest POI and press the 'select' button or the 'left' softkey.
SD 6: The 'mouse pointer' moves to the right position and then shows the information on the POI on a new screen.
UA 7: Press the 'right' softkey.
SD 7: The inzoomed map is displayed again.
UA 8: Press the 0 digit and then press the 4 digit (or left on the joystick)
SD 8: The mouse pointer is deactivated and the screen scrolls to the next area.

The four questions asked:

1. Is the effect of the action the same as the user's goal at that point?
2. Will users see that the action is available?
3. Once users have found the correct action will they know it is the one they need?
4. After the action is taken, will users understand the feedback they get?

The evaluators answered these questions with every action completed and told a story about the usability of the system, may it be a success story or a failure story. We know that our intended users don't have that much experience in the field and that it perhaps take some time for them to get used to the interface and navigation, we had that in mind when we did the tests. The failure stories and some other guidelines we got from the test were then put into a failure document.

Appendix K: The test subjects

Evaluator 1: Mats Lantz **Date: 24/11-2006 13:00**

UA 1: Press the 'select' button, or the 'left' softkey.

Question 1. Is the effect of the action the same as the user's goal at that point?
Could be, it depends if the user wants to check on the stores directly, but if we look at our task at hand it should be the same goal.

Question 2. Will users see that the action is available?
Yes they will, they can't mistake it for something else.

Question 3. Once users have found the correct action will they know it is the one they need?
The text should have said something else. The user won't know what the update is for, could be for the POIs or for the application itself. (F)

Question 4. After the action is taken, will users understand the feedback they get?
Missing what is downloaded and if the update is successful. (F)

UA 2: Press the 'select' button, or press the 'left' softkey.

Question 1. Is the effect of the action the same as the user's goal at that point?
Yes, there is no doubt that this is how it should function. The map should perhaps be the first thing the user will always see.

Question 2. Will users see that the action is available?
Yes, that is definitely visible.

Question 3. Once users have found the correct action will they know it is the one they need?
Yes, the user should see that it's the one they need.

Question 4. After the action is taken, will users understand the feedback they get?
The user shouldn't be surprised of what's happening. It's quite clear that the map is shown.

UA 3: Press the 2,4,6,8 digits (or the joystick) and navigate to the centre of Halmstad and press the 'select' button or the 'left' softkey.

Question 1. Is the effect of the action the same as the user's goal at that point?
It would be better if the centre of Halmstad is already visible. It could be difficult for the users to find where that is on the map. It has to be some kind of information on that somewhere. (F)

Question 2. Will users see that the action is available?
Yes they will see that the button is available.

Question 3. Once users have found the correct action will they know it is the one they need?
Perhaps, but they need to know where the centre of Halmstad is resided. (F)

Question 4. After the action is taken, will users understand the feedback they get?
Could be difficult for the user to know where they are. It would perhaps be easier for the user if it's connected to the big map by showing, for example, "A5" on both the overview map and the detailed map. (F)

UA 4: Press the select button or the 'left' softkey button.

Question 1. Is the effect of the action the same as the user's goal at that point?
They should want to see the grocery stores.

Question 2. Will users see that the action is available?
The button is definitely visible.

Question 3. Once users have found the correct action will they know it is the one they need?
They would perhaps not see that they change hotels to groceries by pressing 'skins'. Will they know what 'skins' mean, it could mean something else. (F)

Question 4. After the action is taken, will users understand the feedback they get?
When they see the response they probably won't be surprised by the feedback they get (even if they are unsure of what skins mean).

UA 5: Press the 'select' button or the 'left' softkey button. Then press the right softkey.

Question 1. Is the effect of the action the same as the user's goal at that point?
Yes, if they just want to show one or many skins it should be quite obvious.

Question 2. Will users see that the action is available?
Yes they will see that it's visible.

Question 3. Once users have found the correct action will they know it is the one they need?
Should be changed to 'back', it's better than the words 'show'. (F)

Question 4. After the action is taken, will users understand the feedback they get?
Yes, if they change colors (POI) and the text will change to groceries, instead of hotels, it would be alright.

UA 6: Press the 2,4,6,8 digits (or the joystick) and navigate to the nearest POI and press the 'select' button or the 'left' softkey.

Question 1. Is the effect of the action the same as the user's goal at that point?
Yes it is.

Question 2. Will users see that the action is available?
Yes it is visible on the screen, has to be showed more clearly though.

Question 3. Once users have found the correct action will they know it is the one they need?
They need to show that a POI is clickable. It needs to change colors and the event name has to be shown. (F)

Question 4. After the action is taken, will users understand the feedback they get?
Yes they will probably not have any problem to understand the feedback that they get.

UA 7: Press the 'right' softkey.

Question 1. Is the effect of the action the same as the user's goal at that point?
The user will want to go back, but they could also want to scroll between all the POI available in the grocery skin and then show them on the map.

Question 2. Will users see that the action is available?
Yes they will.

Question 3. Once users have found the correct action will they know it is the one they need?
Yes they should see that the 'back' will take them back to the screen.

Question 4. After the action is taken, will users understand the feedback they get?
The users should understand what is happening.

UA 8: Press the 0 digit and then press the 4 digit (or left on the joystick)

Question 1. Is the effect of the action the same as the user's goal at that point?
No, the user will probably try to scroll from the beginning without turning the pointer off. (F)

Question 2. Will users see that the action is available?
It's not visible from the beginning; you have to turn it off. This is probably not user friendly accordingly to the user. (F)

Question 3. Once users have found the correct action will they know it is the one they need?
How would they know that they could disable the pointer with '0' key? It should be more visible. (F)

Question 4. After the action is taken, will users understand the feedback they get?
If they have seen that the picture has changed, they could see the change, but it would be better if the screen show where they have been (F)

Appendix K: The test subjects

Evaluator 2: Domante Olekaite **Date: 24/11-2006 14:00**

UA 1: Press the 'select' button, or the 'left' softkey.

Question 1. Is the effect of the action the same as the user's goal at that point?
Yes, the user would probably press the 'select' or the 'left' softkey

Question 2. Will users see that the action is available?
Yes it is definitely visible.

Question 3. Once users have found the correct action will they know it is the one they need?
Yes, I think it obvious that they will update the application, at least the second time. There could be a problem for first time users.

Question 4. After the action is taken, will users understand the feedback they get?
Yes they will understand the feedback they get

UA 2: Press the 'select' button, or press the 'left' softkey.

Question 1. Is the effect of the action the same as the user's goal at that point?
Yes, the user should want to see the map at this stage

Question 2. Will users see that the action is available?
They can see the button and see 'show map'.

Question 3. Once users have found the correct action will they know it is the one they need?
Yes it's quite clear that it's the one the user will need in order to show the map.

Question 4. After the action is taken, will users understand the feedback they get?
Yes, the overview map is shown and the user expected to see a map so this is also quite clear.

UA 3: Press the 2,4,6,8 digits (or the joystick) and navigate to the centre of Halmstad and press the 'select' button or the 'left' softkey.

Question 1. Is the effect of the action the same as the user's goal at that point?
The user would definitely try to navigate with the joystick to correct area.

Question 2. Will users see that the action is available?
Yes they will see that zoom is available

Question 3. Once users have found the correct action will they know it is the one they need?
Could be difficult to find the correct way to the "centre of Halmstad", If we show some rough areas on the map, where the, for example, centre resides, it would be easier for the user. (F)

Question 4. After the action is taken, will users understand the feedback they get?
The user will not have a problem with the feedback that they get.

UA 4: Press the select button or the 'left' softkey button.

Question 1. Is the effect of the action the same as the user's goal at that point?
It should definitely be the user's first thought. I would want to change the skins first

Question 2. Will users see that the action is available?
Yes it is visible for the user, it's not hidden.

Question 3. Once users have found the correct action will they know it is the one they need?
Yes, I would press the skins option because it's the only one that's visible.

Question 4. After the action is taken, will users understand the feedback they get?
The user shouldn't be surprised of what is visible on the screen.

UA 5: Press the 'select' button or the 'left' softkey button. Then press the right softkey.

Question 1. Is the effect of the action the same as the user's goal at that point?
Confusion for the user, they'll have to mark them in order to show the skins. (F)

Question 2. Will users see that the action is available?
Yes, the buttons are not hidden.

Question 3. Once users have found the correct action will they know it is the one they need?
Maybe not, they should have some other text instead of 'show'. Why not use 'ok' instead? (F)
Question 4. After the action is taken, will users understand the feedback they get?
Yes, if the screen shows that the skin has changed (by using the text in the left corner).

UA 6: Press the 2,4,6,8 digits (or the joystick) and navigate to the nearest POI and press the 'select' button or the 'left' softkey.

Question 1. Is the effect of the action the same as the user's goal at that point?
Yes I would try to navigate the marker.

Question 2. Will users see that the action is available?
Yes they will see that it's available

Question 3. Once users have found the correct action will they know it is the one they need?
If they move it it's ok, but they need information that the icon is clickable and it could be confusing that 'skin' change to 'show'.

Question 4. After the action is taken, will users understand the feedback they get?
Yes if the menu is shown and a transparent view of the map is shown.

Appendix K: The test subjects

UA 7: Press the 'right' softkey.

Question 1. Is the effect of the action the same as the user's goal at that point?
Yes this should definitely be the user's goal at this point.

Question 2. Will users see that the action is available?
Yes, it's not a lot of other options available.

Question 3. Once users have found the correct action will they know it is the one they need?
They will understand that they can get back

Question 4. After the action is taken, will users understand the feedback they get?
It won't be a problem, it could be better if it's transparent though.

UA 8: Press the 0 digit and then press the 4 digit (or left on the joystick)

Question 1. Is the effect of the action the same as the user's goal at that point?
No probably not, I would try with the joystick first to navigate to the left area. Or press back and then navigate to the left area. (F)

Question 2. Will users see that the action is available?
The button is available but they won't see the hidden pointer. (F)

Question 3. Once users have found the correct action will they know it is the one they need?
No point to deactivate first and then scroll, the users wouldn't understand that. They could also want to use back instead and navigate on the overview map. (F)

Question 4. After the action is taken, will users understand the feedback they get?
Only if the user will see that other grocery icons are available. (F)

Appendix K: The test subjects

Evaluator 3: Egidija Charzevskyte **Date: 24/11-2006 15:00**

UA 1: Press the 'select' button, or the 'left' softkey.

Question 1. Is the effect of the action the same as the user's goal at that point?
Yes, I think it's logical for the user. They would definitely choose yes here.

Question 2. Will users see that the action is available?
Yes they will see it.

Question 3. Once users have found the correct action will they know it is the one they need?
Maybe the user doesn't know that you have to update the application in order to show the skin. Better information on what the update does. (F)

Question 4. After the action is taken, will users understand the feedback they get?
It would be clearer if it says download 100%. Somewhere the user should perhaps accept and then move to the next screen. (F)

UA 2: Press the 'select' button, or press the 'left' softkey.

Question 1. Is the effect of the action the same as the user's goal at that point?
Yes they would want to show the map.

Question 2. Will users see that the action is available?
Yes it's visible for the user.

Question 3. Once users have found the correct action will they know it is the one they need?
It could be easier if it said 'ok' instead of 'accept'.

Question 4. After the action is taken, will users understand the feedback they get?
Yes it wouldn't be a problem to understand the feedback that the user will get from this.

UA 3: Press the 2,4,6,8 digits (or the joystick) and navigate to the centre of Halmstad and press the 'select' button or the 'left' softkey.

Question 1. Is the effect of the action the same as the user's goal at that point?
Maybe, I would try to scroll to the correct area, but they would have to know where the centre of Halmstad is located. (F)

Question 2. Will users see that the action is available?
Yes, sooner or later they will see the correct button. It's not invisible to the user.

Question 3. Once users have found the correct action will they know it is the one they need?
Yes, it shouldn't be a problem to use the joystick and push on zoom in

Question 4. After the action is taken, will users understand the feedback they get?
Yes, but they could be missing a visible scale, this will help the user understand how big of a square they have zoomed in to. (F)

Appendix K: The test subjects

UA 4: Press the select button or the 'left' softkey button.

Question 1. Is the effect of the action the same as the user's goal at that point?
The user would probably try to navigate first instead of choosing the skins. This would not be a problem if the hotels were not showing. (F)

Question 2. Will users see that the action is available?
Yes, they should see that it's available.

Question 3. Once users have found the correct action will they know it is the one they need?
It would be better if it said something else, 'skins' could be confusing for the user. (F)

Question 4. After the action is taken, will users understand the feedback they get?
Yes, they would understand the feedback they get when they push the button.

UA 5: Press the 'select' button or the 'left' softkey button. Then press the right softkey.

Question 1. Is the effect of the action the same as the user's goal at that point?
They would probably want to press the 'show' button direct, so it's perhaps not the same action. (F)

Question 2. Will users see that the action is available?
It's visible, although not us much as the user would like to.

Question 3. Once users have found the correct action will they know it is the one they need?
Only if 'show' is changed to something else and the user don't have to press both 'accept' and 'show' to change skins. (F)

Question 4. After the action is taken, will users understand the feedback they get?
They will know if the text changes, but it would also be great if the color of the icons will change.

UA 6: Press the 2,4,6,8 digits (or the joystick) and navigate to the nearest POI and press the 'select' button or the 'left' softkey.

Question 1. Is the effect of the action the same as the user's goal at that point?
Could be a problem to navigate to the right point of interest, show more information that you can push on an icon. (F)

Question 2. Will users see that the action is available?
Yes it's visible (although it has to be highlighted).

Question 3. Once users have found the correct action will they know it is the one they need?
The 'show' button could be confusing for the user, it would be better if the user would see 'ok' instead

Question 4. After the action is taken, will users understand the feedback they get?
The user should see and understand the feedback that they get.

Appendix K: The test subjects

UA 7: Press the 'right' softkey.

Question 1. Is the effect of the action the same as the user's goal at that point?
If the user would want to go back, which he/she would want to, it's quite obvious.

Question 2. Will users see that the action is available?
Yes the user can see the button.

Question 3. Once users have found the correct action will they know it is the one they need?
It's the only choice the user has, so yes, they will know that it's the correct action.

Question 4. After the action is taken, will users understand the feedback they get?
Yes, the feedback that the user will get is quite clear.

UA 8: Press the 0 digit and then press the 4 digit (or left on the joystick)

Question 1. Is the effect of the action the same as the user's goal at that point?
No, the user would probably want to use 'back' instead of navigating to the left. (F)

Question 2. Will users see that the action is available?
No, they wouldn't see the pointer turned off. (F)

Question 3. Once users have found the correct action will they know it is the one they need?
No, it's not logical for the user. You can't expect the user to first press 'zero' and then navigate to the left. The user should be able to navigate to the left first.

Question 4. After the action is taken, will users understand the feedback they get?
The user would perhaps want some feedback on the action performed (not just changing the map).

Appendix K: The failure document

User action 1: Press the 'select' button, or the 'left' softkey.

- The text should have said something else. The user won't know what the update is for, could be for the POIs or for the application itself.
- Missing what is downloaded and if the update is successful.
- Maybe the user doesn't know that you have to update the application in order to show the skin. Better information on what the update does.
- It would be clearer if it says download 100%. Somewhere the user should perhaps accept and then move to the next screen.

User action 3: Press the 2,4,6,8 digits (or the joystick) and navigate to the centre of Halmstad and press the 'select' button or the 'left' softkey.

- It would be better if the centre of Halmstad is already visible. It could be difficult for the users to find where that is on the map. It has to be some kind of information on that somewhere.
- Perhaps, but they need to know where the centre of Halmstad is resided.
- Could be difficult for the user to know where they are. It would perhaps be easier for the user if it's connected to the big map by showing, for example, "A5" on both the overview map and the detailed map.
- Could be difficult to find the correct way to the "centre of Halmstad", If we show some rough areas on the map, where the, for example, centre resides, it would be easier for the user.
- Maybe, I would try to scroll to the correct area, but they would have to know where the centre of Halmstad is located.
- Yes, but they could be missing a visible scale, this will help the user understand how big of a square they have zoomed in to.

UA 4: Press the select button or the 'left' softkey button.

- The user would probably try to navigate first instead of choosing the skins. This would not be a problem if the hotels were not showing.
- It would be better if it said something else, 'skins' could be confusing for the user.
- They would perhaps not see that they change hotels to groceries by pressing 'skins'. Will they know what 'skins' mean, it could mean something else.

UA 5: Press the 'select' button or the 'left' softkey button. Then press the right softkey.

- They would probably want to press the 'show' button direct, so it's perhaps not the same action.
- Only if 'show' is changed to something else and the user don't have to press both 'accept' and 'show' to change skins.
- Confusion for the user, they'll have to mark them in order to show the skins.
- Maybe not, they should have some other text instead of 'show'. Why not use 'ok' instead?

UA 6: Press the 2,4,6,8 digits (or the joystick) and navigate to the nearest POI and press the 'select' button or the 'left' softkey.

- They need to show that a POI is clickable. It needs to change colors and the event name has to be shown.
- Could be a problem to navigate to the right point of interest, show more information that you can push on an icon.

Appendix K: The failure document

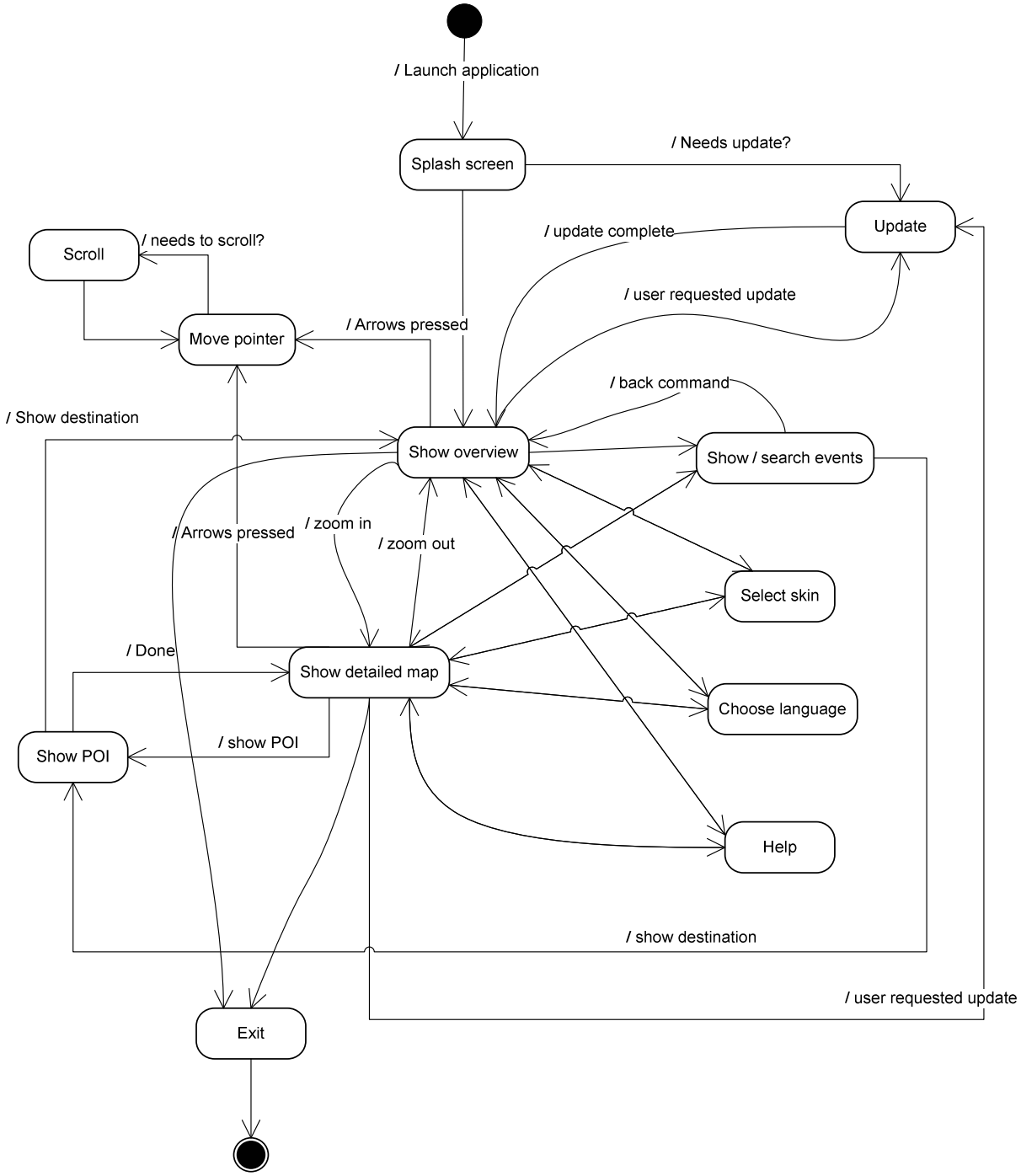
UA 8: Press the 0 digit and then press the 4 digit (or left on the joystick)

- No, the user will probably try to scroll from the beginning without turning the pointer off.
- It's not visible from the beginning; you have to turn it off. This is probably not user friendly accordingly to the user
- How would they know that they could disable the pointer with '0' key? It should be more visible
- If they have seen that the picture has changed, they could see the change, but it would be better if the screen show where they have been.
- No, the user would probably want to use 'back' instead of navigating to the left.
- No, they wouldn't see the pointer turned off.
- No probably not, I would try with the joystick first to navigate to the left area. Or press back and then navigate to the left area.
- The button is available but they won't see the hidden pointer.
- No point to deactivate first and then scroll, the users wouldn't understand that. They could also want to use back instead and navigate on the overview map.
- Only if the user will see that other grocery icons are available.

New design ideas

- The map will be seen first and then they could choose a menu.
- Show big landmarks on the map.
- Solve the navigation by showing a small overview map in the corner of the detailed map.
- It would perhaps be easier for the user if it's connected to the big map by showing, for example, "A5" on both the overview map and the detailed map.
- The skins option should be showed earlier. You could change the skins the first time you open the application
- The pointer should animate on to the screen.
- The user could scroll between the different events and show the information on them and then show where they're on the map.
- When you move to the corner the pointer changes to an arrow and it shows that the user can scroll or it scroll automatically when you move to the end of the screen.
- Show where they have been before. Showing that A5 is to the right and A3 is to the left. It depends on how much they can scroll
- If we show some rough areas on the map where the, for example, centre resides it would be easier for the user.
- It would be clearer if it says download 100%. Somewhere the user should perhaps accept and then move to the next screen.
- Language and help can be accessed everywhere.
- First time the user starts the application they can decide what skins they should show. This is before the map is showed.

Appendix L: State diagram of the GUI



Appendix M: The acceptance test

Test person: **Mobile phone:**

MODULE 1: Update application

Task: The user should connect to the database and update the application.

Form based Script	Correct	Date	Initials
1. Is the text visible enough, is it using an acceptable color scheme and is the size ok?			
2. Is the text logical and understandable for menus and buttons?			
3. If the help text is used, is it to any use for the function?			
4. Are the warning messages understandable?			
5. Does it take less than three seconds before the application gives a response to a pressed button?			
6. Are all buttons available in order to execute the function?			
7. Does the function work in a correct way without giving failure messages or crashing the application?			

The general questions
Question 1: How was your experience with the tourist service/application?
Question 2: What positive thoughts came from using this application? Why?
Question 3: What negative thoughts came from using this application? Why?
Question 4: How did you experience the navigation of the application (to move around and find information)?
Question 5: Do you feel that the phones that you used were suitable for this service?
Question 6: Do you think that you could start using this service as a tourist or as someone who already lives in a city?

Appendix N: Functionality test, the administration platform

Functional for the clients

1.1 Register client:

Register Name: Success at 1-20 characters, failure at <1 and >20

YES NO

Register Address: Success at 1-50 characters, failure at <1 and >50

YES NO

Register Opening hours: Success at 1-40 characters, failure at <1 and >40

YES NO

Register Telephone number: Success at 1-15 characters, failure at <1 and >15

YES NO

Register Contact person: Success at 1-30 characters, failure at <1 and >30

YES NO

Register mail: Success at 1-40 characters, failure at <1 and >40 and use of @ and a wrong formatted email address

YES NO

Register x and y: Success at 1-8 characters and dot found on the map, failure at <1 and >8 and if it's outside the 1978-2002 space

YES NO

Register type of event: Success when all things are selectable and it's working correctly, failure at no event available

YES NO

Accept the registration: Success at message "your registration will soon be finished", failure at no message.

YES NO

Receive a mail about the registration: Success at mail: "You can now log in with this member name and password", failure at no such mail

YES NO

1.2 *Retrieve the lost password*: Success when correct answer has been written and mail sent out, failure when another email address is getting the mail.

YES NO

1.3 Login the client: Success when member sees it store or give an error message for wrong password and user, failure at error message and can't login even though the right password and user name is used.

YES NO

1.4. Register comments:

Delete old comments: Success when deleted from database, failure at still there

YES NO

Edit old comments: Success at comment changed, failure at still there

Yes NO

Choose a store: Success at showing the right store, failure at none shown

Yes NO

Register comments: Success at registering max 400 characters comments, failure at <1 and >400 and no comments at all in the database.

YES NO

Appendix N: Functionality test, administration platform

Register start and stop date: Success at correct day time formatting “2005-01-10 19:08:00”, failure when using another formatting and stop date is before start date
YES NO
Accept the registration: Success when the comment is in the database and a message says that it’s correct, failure at no info or wrong info in the database
YES NO

1.5 Register new shop:
Register Name: Success at 1-20 characters, failure at <1 and >20
YES NO
Register Address: Success at 1-50 characters, failure at <1 and >50
YES NO
Register Opening hours: Success at 1-40 characters, failure at <1 and >40
YES NO
Register Telephone number: Success at 1-15 characters, failure at <1 and >15
YES NO
Register Contact person: Success at 1-30 characters, failure at <1 and >30
YES NO
Register mail: Success at 1-40 characters, failure at <1 and >40, must use @ and a viable email address
YES NO
Register x and y: Success at 1-8 characters and dot found on the map, failure at <1 and >8 and if it’s outside the 1978-2002 space
YES NO
Register type of event: Success when all things are selectable and it’s working correctly, failure at no event available or nothing is in the database.
YES NO
Accept the registration: Success at message “your registration has been finished” and shop is in the database, failure at no message or no new shop in database.
YES NO

1.6 Update information on a shop
Update Name: Success at 1-20 characters, failure at <1 and >20
YES NO
Update Address: Success at 1-50 characters, failure at <1 and >50
YES NO
Update Opening hours: Success at 1-40 characters, failure at <1 and >40
YES NO
Update Telephone number: Success at 1-15 characters, failure at <1 and >15
YES NO
Update Contact person: Success at 1-30 characters, failure at <1 and >30
YES NO
Update mail: Success at 1-40 characters, failure at <1 and >40, must use @ and a viable email address
YES NO
Update x and y: Success at 1-8 characters, failure at <1 and >8 and if it’s outside the 1978-2002 space
YES NO

Accept the Update: Success at message "your registration has been finished" and shop is in the database, failure at no message or no new information in database.
YES NO
Cancel the update: Success at nothing has changed for the shop; failure at the info has changed.
YES NO

1.7. Change the password: Success at new password working, failure at new password doesn't work or the old one hasn't changed
YES NO

1.8. Log out the client: Success when the page returns to the front page, failure at nothing happens
YES NO

2.1 Registering new temporary event:
Register store name: Success at 1-40 characters, failure at <1 and >40
YES NO
Register Address: Success at 1-30 characters, failure at <1 and >30
YES NO
Register Opening hours: Success at 1-40 characters, failure at <1 and >40
YES NO
Register x and y: Success at 1-8 characters, failure at <1 and >8 and if it's outside the 1978-2002 space
YES NO
Register comments: Success at registering max 400 characters comments, failure at <1 and >400 and no comments at all in the database.
YES NO
Register start and stop date: Success at correct day time formatting "2005-01-10 19:08:00", failure when using another formatting and stop date is before start date
YES NO
Accept the registration: Success at message "your registration has been finished" and the event is in the database, failure at no message or no new event in database.
YES NO

Functional for the administrations
1.1 Login the admin: Success when admin sees it store or give an error message for wrong password and user, failure at error message and can't login even though the right password and user name is used.
YES NO

1.2 Create new clients:
Register Client name: Success when name appears in the database (the asp tables), failure when the name is not in the tables
YES NO
Register Name: Success at 1-20 characters, failure at <1 and >20
YES NO
Register Address: Success at 1-50 characters, failure at <1 and >50
YES NO

Appendix N: Functionality test, administration platform

Register Telephone number: Success at 1-15 characters, failure at <1 and >15
YES NO
Register Contact person: Success at 1-30 characters, failure at <1 and >30
YES NO
Register mail: Success at 1-40 characters, failure at <1 and> 40 and use of @ and a wrong formatted email address
YES NO
Register x and y: Success at 1-8 characters and dot found on the map, failure at <1 and >8 and if it's outside the 1978-2002 space
YES NO
Register type of event: Success when all things are selectable and it's working correctly, failure at no event available
YES NO
Accept the registration: Success at message "your registration is in the database", failure at no message and nothing in the database
YES NO

1.3 List all the clients: Success when all clients in the database are in the list, failure when you don't see the clients even though they are in the database.
YES NO

1.4 Delete the clients:
Delete the clients: Success when the clients have been deleted correctly in the database (all shops and all comments and client name), failure when they are still in the database.
YES NO
Delete the shops: Success when the shops have been deleted correctly in the database (all shops and all comments), failure when they are still in the database.
YES NO

1.5 Log out: Success at the page returns to the front page, failure at nothing happens
YES NO

2.1 Search for the shops: Success when you can find the specific shop, it's not working correctly if you don't find the specific shop
YES NO

2.2 Edit clients information: Success when you can edit their name and their shops, failure when nothing is changing in the database
YES NO

2.3 Comments
Delete comments: Success when deleted from database, failure at still there
YES NO
Edit comments: Success at comment changed, failure at still there
Yes NO